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The Municipal University of Akron

Akron, Ohio

June, 1914

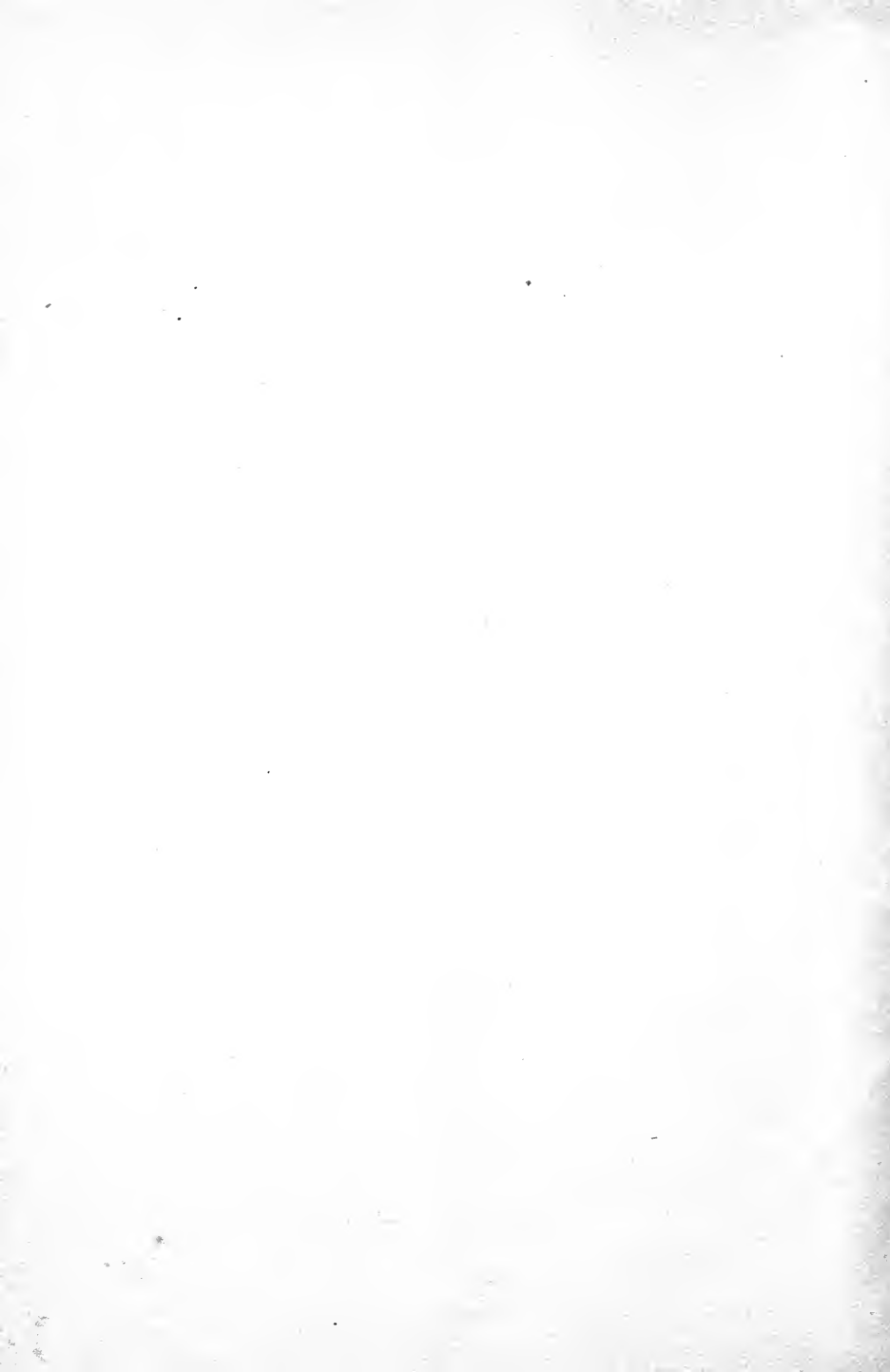
Akron Pavements

By

Fred. E. Ayer



Office of the Dean,
College of Engineering



A REPORT
OF AN
INVESTIGATION

MADE BY

THE MUNICIPAL
UNIVERSITY OF AKRON

FRED. E. AYER, DEAN,
COLLEGE OF ENGINEERING

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RESOLUTION No. 4239

With Regard to Investigation of Paving in the City of Akron

BE IT RESOLVED By the Council of the City of Akron, State of Ohio,

SECTION 1. That the Municipal University of the City of Akron be and is hereby requested and directed to investigate fully the present condition, cost and durability of the pavements of the City of Akron, with the view of the City adopting some method of greater efficiency for the outlay and a reduction of cost to the citizens; with the view also of the City considering the advisability of adopting the direct method of pavement construction. Further, to report upon the various types of pavements in general use, their cost and adaptability to various classes of traffic; also showing the difference, if any, to the City of the contract system at present in vogue and the direct method by the City of performing municipal work.

SEC. 2. That the Clerk is hereby directed to transmit a copy of this resolution to the Municipal University of the City.

Passed February 23, 1914.

IRA H. PRIEST,
Clerk of Council.

J. W. WALKER,
President of Council.

Approved February 25, 1914.

FRANK W. ROCKWELL, Mayor.

MUNICIPAL UNIVERSITY OF AKRON, OHIO.

P. R. KOLBE, Ph.D., *President.*

C. R. OLIN, M.S., *Secretary.*

June 19, 1914.

Akron City Council,

Gentlemen: In response to your wish as expressed in your resolution of February 23, 1914, asking that the Municipal University investigate various points on paving conditions in the city of Akron, we beg to submit to you, herewith, the results of an investigation carried on under the direction of the College of Engineering and extending over a period of several months.

Respectfully yours,

P. R. KOLBE,
Chairman Board of Directors.

MUNICIPAL UNIVERSITY OF AKRON,
AKRON, OHIO.

COLLEGE OF ENGINEERING.
Office of the Dean.

June 19, 1914.

To the President and Board of Directors:

I have made an investigation of the pavements of Akron as per your instructions and herewith submit my report. On account of my other duties, I could give but a limited time to this work and the University could not afford the money necessary for a complete investigation. Therefore the results obtained are not comparable with what might have been expected from a complete survey made by a qualified Bureau of Municipal Research. I believe, however, that this report contains information of value to the council and the taxpayers of the city.

Respectfully,

FRED E. AYER, Dean.

INTRODUCTION

In making this investigation the Engineering Department was handicapped by its youth. The department is just being organized and at the time this work was undertaken it had no library and no faculty except the Dean. Some of the latest books and reports of different organizations dealing with the subject have been purchased and other books and periodicals in the libraries of Case School of Applied Science and the University of Cincinnati have been freely consulted. Different city officials and civic organizations have contributed data and reports, but the following extract from the report of the Cleveland Chamber of Commerce on the pavements there applies equally well to this investigation. "From several of these cities valuable information was received, but we were surprised to find how little tabulated information was obtainable upon this important subject, and how little consideration had been given to it by civic organizations and city officials in the more important cities of this country."

The following men and organizations were employed and paid from the fund appropriated by the University for this work :

Two co-operative students in Civil Engineering from the University of Cincinnati inspected every pavement in the city and classified it as to its present condition.

Four students of the University of Akron tabulated the data thus obtained.

The New York Bureau of Municipal Research made a complete report upon the paving specifications.

The American Society of Civil Engineers made a search in its library and furnished a bibliography on paving materials covering publications made during the last two years. (Appendix A, page 36).

The investigation is incomplete in a number of important points. A study of the method of financing the cost of constructing new pavements and repairing old ones should be made and a competent committee, after a careful study of present conditions, might be able to offer valuable suggestions. An investigation of some of the older pavements, the specifications governing their construction, their cost, length of service, method of failure, etc., would prevent the repetition of discovered errors in the construction and maintenance of new work. A careful study of the present organization of the departments of engineering, street repairing and street cleaning would undoubtedly suggest changes other than those mentioned herein which would increase the general efficiency of these departments. The Engineering Department of the City University is very willing to contribute its services and equipment toward the solution of any of the city's problems and expresses the hope that the City Government will be able to use it in a manner mutually advantageous.

The language of the resolution directing the University to make this investigation indicates that a definite recommendation is expected in two important particulars, viz: the proper kind of paving materials to be used in Akron, and whether the pavements should be laid by contract or by labor directly employed by the city. The University can be of material assistance in furnishing information upon such questions, but final decision rests with the city officials. The University is primarily an educational institution and cannot assume to dictate the policies of the city administration.

MAGNITUDE OF THE PROBLEM

Mr. William H. Connell, Chief of the Bureau of Highways and Street Cleaning, Philadelphia, Pennsylvania, made the following statement at the sixty-first annual meeting of the American Society of Civil Engineers held January 21 and 22, 1914.

"Before closing, and in order that all may realize the magnitude of the work of highway bureaus in comparison with that of other engineering organizations, the writer calls attention, for example, to the extent of the undertaking of the Water Board of the City of New York in connection with the new water supply from the Catskill Mountains and vicinity. This work is said to be second only to the construction of the Panama Canal—the greatest piece of engineering work of the twentieth century. Now, no matter what may be the nature of the work requiring large expenditures, it is just as necessary to see that the money is spent judiciously and to the best advantage in one branch of engineering as in another. Therefore, attention is called to the excellent engineering organization of the Water Board of New York City, with which all are more or less familiar, and which is, without doubt, the best organization of the kind in the world, as compared with the general character of the inadequate highway organizations having jurisdiction over the expenditure of large sums of money. Then compare the expenditures of the Water Board for construction for the years 1905 to 1913, with those of New York, Chicago and Philadelphia, respectively, for highway construction and maintenance, street cleaning, and collection and disposal of ashes and garbage, for the same period:

From January 1, 1905, to January 1, 1913:

The Water Board expended on construction work	\$87,550,540
New York City expended for construction and maintenance of highways	\$108,523,030
For street cleaning, collection and disposal of ashes and garbage.....	66,953,463
	<hr/>
	175,476,493
Chicago expended for construction and maintenance of highways.....	\$36,846,751

For street cleaning, collection and disposal of ashes and garbage.....	16,209,179	
		<hr/>
		53,055,930
Philadelphia expended for construction and maintenance of highways	\$17,445,085	
For street cleaning, collection and disposal of ashes and garbage.....	12,904,030	
		<hr/>
		\$30,349,115

"Now, without going into the question of the personnel of the respective organizations, it is obvious that the same importance should be attached to the character of the organization controlling one class of work as another, per dollar of expenditure; but judging from a purely business and engineering point of view, it would seem that there is a general tendency not to regard it as necessary to provide as adequate an organization to supervise the expenditure of moneys on highways as is the case with other engineering undertakings, and this is a matter which should be given serious consideration."

"The foregoing figures come from reliable sources and are substantially correct. The details of the personnel of the Water Board and of the highway engineering organizations have not been stated as it is thought that their general character is sufficiently well known."

Proceedings of the American Society of Civil Engineers, Vol. XL, No. 2, pages 414 to 416.

The Annual Report of the City of Youngstown, Ohio, gives the estimated value of its total paving as \$2,271,946.00.

"Cleveland has 500 miles of pavements, the original cost of which averaged approximately \$60,000 per mile."

"If the average life of a pavement is twenty years, an average of twenty-five miles must be repaved annually, at an expense of \$1,500,000."

"It may be interesting to note that if the policy were pursued for twenty years of repaving twenty-five miles per year, and twenty-year paving bonds were issued at the rate of 4½ per cent. per annum, the annual cost for sinking fund and interest would be \$2,340,000."*

Akron has 104 miles of paved streets. Assuming an average of thirty feet in width and the low estimate of \$2.00 per square yard for the original cost, the pavements of the city represent an outlay of over three and one-half millions of dollars. If the average life of these pavements be taken as fifteen years, then seven miles of repaving must be done per year. \$2.00 per square yard for a pavement thirty feet wide amounts to \$35,000 per mile and to repave seven miles per year would require an annual outlay of \$245,000, not taking account of interest or sinking fund.

PRESENT CONDITIONS

According to the report of the City Engineer for the year 1913, Akron has 104.43 miles of pavements distributed as follows:

Brick	96.11 miles
Medina Stone	2.65 "
Macadam	3.66 "
Asphalt, Sheet and Block.....	.68 "
Concrete27 "
Creosote Block	1.06 "
	<hr/>
	104.43 "

An inspection of the paved streets was made and they were classified as follows:

A—Smooth; even surfaces,
no humps or hollows;
not appreciably worn.....52.02 miles—56.4%

*Cleveland Pavements, A Report of the Municipal Committee of the Cleveland Chamber of Commerce, May, 1914.

B—Same as A but appreciably worn, does not require extensive repairs 20.42 miles—22.1%

C—More or less uneven due to the repair of numerous openings, considerably worn but could be repaired so as to last a few years. Foundation good enough to allow resurfacing15.15 miles—16.4%

D—Very uneven and worn. Not worth repairing but should be repaved..... 4.73 miles— 5.1%

Considering A and B together, and C and D together, 78.5% of Akron's pavements are in good condition and 21.5 per cent. need repaving or extensive repairs.

With about 16% of the pavements needing extensive repairs and about 5% in need of repaving, conditions are not as bad as the casual observer would expect. The reason that Akron's pavements appear to be in such bad condition is because the poor pavements are on the streets that are used the most, notably, West Market, Exchange and Main streets. And yet new streets in the residence districts are improved each year leaving these main thoroughfares in such condition that traffic avoids them whenever possible.

Akron is better off than Cleveland, which is reported by the Cleveland Chamber of Commerce to have 500 miles of pavements and approximately fifty miles of these in need of repaving. Ten per cent. of the paved streets of Cleveland and only 5 per cent. of those of Akron need repaving.

Two hundred and thirty-one openings in bad repair were noted or an average of approximately 2.3 badly repaired openings per mile. In the majority of these the defective workmanship is not in the repaving but in the back filling.

Their level is either above or below that of the surrounding pavement.

STREET RAILWAYS.

The pavements inside the street railway tracks were inspected on 15.8 miles of streets. On 9.3 miles or nearly 60% the condition inside the tracks was found to be the same as that outside. The condition of the remaining 40% is shown in the following table.

OUTSIDE OF TRACK				INSIDE OF TRACK			
A	B	C	D	A	B	C	D
1.08 mi	2.25 mi	2.03 mi	1.11 mi	.67 mi	1.28 mi	2.52 mi	2.0 mi
17%	34%	31%	18%	10%	20%	39%	31%
51%		49%		30%		70%	

Note: Lineal miles of streets considered regardless of whether occupied by single or double tracks.

In general, then, the pavements inside the car tracks are in about as good condition as those on the remainder of the street.

Section 239 of the Revised Ordinances of the City of Akron, Ohio, 1908, reads as follows:

“Any individual or company to whom any such privilege shall be granted upon any street shall be required, when it is deemed necessary by the council or its successors, to pave or repave, macadamize or remacadamize, such street, to pave or repave, macadamize or remacadamize the space between the rails of the tracks, turn-outs and switches used by them, and one foot on the outside of such rails on both sides of said tracks, and the space known as the “devil strip” through any street or portion thereof through which such street railway may pass; and such paving or macadamizing so done shall be with the same kind and quality of material that shall be used by the corporation for the ad-

joining portion of such street, and such individual or company shall so pave or macadamize, and shall keep in repair the space aforesaid after the same shall have been paved or macadamized, to the satisfaction of the council or its successors during the continuance of any grant."

"To the satisfaction of the council" implies that council must determine when the space inside the tracks should be paved or repaved and see that the railway company does it. The machinery seems to be provided for keeping the space inside the railway tracks paved in as good condition as the remainder of the street. If council has not done its part, no blame can be attached to the railway company for that. It would be manifestly unjust to expect the pavements inside the tracks to be kept in better condition than those outside.

Refined accuracy was not the aim in the above inspection. The students who made the inspection were not pavement experts. The distances were scaled from the city map and the percentages are based on lineal distance only, no account being taken of the varying widths of streets, Macadam pavements were not included. The total mileage according to the figures given in the A, B, C and D classification is 92.32 miles. The total mileage of pavements given by the City Engineer's 1913 report is 104.43. Subtract from this 104 miles, 3.66 miles of Macadam and 3 or 4 miles of streets torn up or in process of repaving and there remain 97 miles. There is a discrepancy, therefore, of 5 or 6 miles, or, the figures given cannot be considered accurate within 5% to 7½%. As this investigation is intended to give a general idea of the condition of Akron pavements and not to make an accurate survey of them, the figures given are considered to be as nearly correct as the object of the investigation requires.

ENGINEERING

Organization—The number of engineers employed and the salaries paid them is not commensurate with the amount of money paid for construction work. A comparison of the amount of money spent for engineering on the new water works and the amount spent for the same purpose upon paving would probably show that per dollar of construction expenditure the engineering supervision of pavements is low. In pioneer days the farmers got together with men and teams and built a road and it is hard to convince people today that the proper paving of a street calls for the services of competent engineers. An engineer should spend considerable time each day on every paving contract of any size, but with the present force that is impossible. The report of the City Engineer for 1913 states that there were employed:

- 1 Engineer ;
- 3 Assistant Engineers ;
- 2 Draftsmen ;
- 3 Rodmen.

Two of these men are graduates of technical colleges, and two others studied in technical institutions but hold no degrees.

The Engineering Department has no supervision over the repair and maintenance of pavements. Some of our ablest highway engineers insist upon repair and maintenance work being done under the direction of the engineering department. This method gives the engineer first hand knowledge of defects in construction and enables him to correct them in future work.

SPECIFICATIONS

The New York Bureau of Municipal Research was employed to examine the specifications and their report is given in full in Appendix A, page 35. These specifications have probably "grown" through a number of ad-

ministrations, and although their intent is good, they should be entirely rewritten.

It is significant to note that the National Paving Brick Manufacturers Association has eliminated all reference to soft fillers in its revised Number One Specification.

INSPECTION

It is universally conceded that good construction work is impossible without proper inspection. Pavement inspectors are paid \$2.75 per day and a paver in the street repair department receives \$4.50 per day. Inspectors are appointed by the Director of Public Service without any particular regard as to their fitness for the work and the Engineering Department has very little authority over them. If it is considered necessary to maintain a construction department separate from the general engineering department, then an engineer should be in charge of it. Unless inspectors are employed who have the necessary qualifications for the job and unless the City Engineer has authority over them and can require comprehensive daily reports, the Engineering Department has no detailed knowledge of the construction in progress.

No adequate inspection is provided for the repairing of street excavations. The best time to inspect back-filling is while it is being done. That back-filling is not properly done is evidenced by the many depressions at places where streets have been opened.

No system of inspection is provided for pavements in general. The city has between three and four millions of dollars invested in pavements and depends upon the general public to inform it when maintenance repairs are necessary. Small defects, if repaired at once, are inexpensive; if not attended to at once, they become large defects very rapidly. Some cities have a regular force of patrol inspectors, and every street is inspected every day. These inspectors also look after street openings that are being repaired and also

report on them at intervals after the repairs are completed. When a repaired opening fails it is noted against the record of the foreman that repaired it.

In Cincinnati co-operative civil engineering students commence as laborers in the street repair gangs, advance to foremen of small gangs and finally become pavement inspectors. Henry M. Waite, formerly City Engineer, of Cincinnati, now City Manager of Dayton, Ohio, says in his 1912 annual report of the Department of Public Works, City of Cincinnati:

"Arrangements were also made with the University whereby students of the engineering course were employed in various capacities in this department. A heightening of the standard of efficiency has resulted from this employment of bright, energetic young men who have chosen to follow engineering as a profession."

TESTING

The Bureau of City Tests of the Municipal University provides a means of testing all materials specified in the pavements and free use of it insures the rejection of any material not up to the standard required.

SELECTION OF PAVEMENT

Considerable time and money would be saved if property owners and city officials could be made to understand that there is no "one best paving material" and that the selection of the proper one for any given conditions is purely an engineering problem. Mr. George W. Tillson, in his book entitled Pavements and Paving Materials, gives a method of selecting the proper material for a given street and a great deal on this subject has been published in the 1913 and 1914 Proceedings of the American Society of Civil Engineers in the discussion on Road Construction and Maintenance. There are other authoritative publications on the subject and only a few points will be considered in this report.

There has been some criticism because Akron has used so much brick pavement. In all engineering construction it is most important to consider the availability of material. The material at hand has a large economic advantage over the material that must be transported. Mr. George W. Tillson in commenting on this point says:

"In the Central West, where there is no rock suitable for pavement, where all outside materials can only be brought in at great expense, Nature has furnished a material—clay—from which can be, and is, manufactured a brick that gives satisfaction and is almost as durable as the best of stone itself."*

KINDS OF PAVEMENT IN DIFFERENT CITIES

The following table gives the kind of pavements laid last year in a few cities selected at random:

CITY	Brick	Wood Block	Sheet Asphalt	Stone(2)	Macadam(3)	Concrete	Report
Akron, Ohio.....	202,948	35,942		18,709			1913
Baltimore, Md.....	161,770	6,683	214,379(1)	150,328	83,597		1913
Baltimore, Md.....	93,383	4,054	217,402	50,067	32,151		1912
Boston, Mass.....	1,520	40,297	27,967(5)	56,994	81,146		Feb. 1, '14
Canton, O.....	198,114						1912
Cincinnati, O.....	47,869	7,654	38,300	61,875	28,833		1912
Cleveland, O.....	18.4 mi.			1.3 mi.	0.7 mi.		1912
Detroit, Mich.....	238,055	464,205	332,386	52,215	4,431	6,354(4)	Jan. '11
							Jan. '12
Milwaukee, Wis.....	8,044			13,075	488,393		1912
St. Louis, Mo.....	26.41 mi.	2.78 mi.	6.70(6)mi	1.45 mi.	1.8 mi.		1912
Youngstown, O. ..	200,583	1,388					1912

(1) 1030 sq. yards asphalt block.

(2) Includes sandstone, cobble and granite block.

(3) Includes Telford, bituminous macadam, bituminous concrete.

(4) Reinforced.

(5) 14,554 sq. yards bitulithic.

(6) 3.52 miles bitulithic.

All figures in square yards except as noted.

There are brick pavements in Cleveland which have been laid from twelve to seventeen years and which are still in perfect condition and have never cost anything for main-

*Discussion: Road Construction and Maintenance, American Society of Civil Engineers Proceedings, Vol. XL, No. 3, page 728.

tenance or repairs. There is no question but that a brick pavement *can* be built so that it will last fifteen or twenty years under heavy traffic.

What constitutes the cost of a pavement is deemed extremely important and the following extract taken from Paving Report No. 6, published by the Cincinnati Bureau of Municipal Research, February, 1912, brings out this point clearly.

"ECONOMY"—The most economical pavement to use under any given conditions is that which will show the lowest average cost per year during the entire period of its existence. Thus a pavement having a relatively high first cost may, owing to its longer life or lower cost of repairs, prove ultimately cheaper than one lower in first cost. This principle of average annual cost* should be thoroughly understood, as it is fundamental in determining a sound and economical paving policy for a city. The average annual cost of a particular pavement may be defined as that amount of money which, if contributed annually, will, under the existing conditions, keep the street perpetually paved and repaired. The average annual cost is composed of three principal factors:

1. Average annual cost of repairs.
2. Interest on the cost of the pavement.
3. Annual charge on account of sinking fund ;
i. e., a fund set aside and invested each year such that the pavement, when worn out, will have been completely paid for.

"This average annual cost might be imagined as a rental. If the streets were laid and kept in repair under a continuous contract with a private corporation, the average annual cost, as above described, plus profits, would make up the rent demanded by the corporation. In the long run, the cost to the citizens under the present methods has to be figured in the same way."

*See report of S. Whinery to Boston Finance Commission, 1906.

"In order to apply this principle to the selection of a pavement for a given street, certain exact data are necessary, such as the durability and cost of repairs of each kind of pavement under various conditions, especially those of traffic. As a matter of fact, the information of this character which is available in most cities is meager and fragmentary, due doubtless to the long period necessary for such an extended investigation and the lack of continuity of records though changing administrations."

"Nevertheless, the principle, even when based on approximate data, may shed considerable light on the economic side of pavements in use here, and incidentally may offer suggestions for desirable records. Accordingly, we shall apply it, as well as available data allow, to the case of Cincinnati pavements." * * * * *

"*SUMMARY*—The following table gives a summary of the foregoing data, on the basis of which is worked out the continuous annual expense per square yard for keeping paved and repaired each different kind of pavement under its actual local conditions:

UNDERLYING DATA	Granite	Wood Block	Bitu-lithic	Asphalt	Brick	Bowlder	Macadam
First cost of surfacing.....	\$2.70	\$2.45	\$1.65	\$1.30	\$1.25	\$1.75	\$0.95
Assumed life.....	25 yrs.	?	?	15 yrs.	15 yrs.	25 yrs.	8 yrs.
AVERAGE ANNUAL COST OF SURFACING							
Interest at 4% on cost of surfacing.....	0.108	0.098	0.066	0.052	0.050	0.07	0.038
Average annual cost of repairs.....	0.026	?	?	0.073	0.012	0.033	0.076
Annual charge for sinking fund.....	0.063	?	?	0.063	0.060	0.041	0.100
Oiling or watering.....							0.04
Total, surfacing.....	0.197			0.188	0.122		
AVERAGE ANNUAL COST OF FOUNDATION.....	0.046	0.046	0.046	0.046	0.046		
Total average annual cost per sq. yd.....	0.243	?	?	0.234	0.168	0.144	0.254

“From the application of this annual expense method, it is seen that the respective costs of granite, asphalt and macadam, under the actual conditions under which each has been used in Cincinnati, are not far apart, while brick is considerably lower. Boulder is disregarded, being obsolete for general use.”

If the taxpayers can be convinced that the cost of a pavement is not its first cost alone, all the work of this investigation will be considered as effort well expended.

TEST PAVEMENTS

Test pavements have frequently been laid in order to compare different paving materials under the same traffic conditions. The Civil Engineer and Architects Journal, London, England, October, 1839, describes “The Experimental Paving of Oxford Street.” (See Engineering News, April 30, 1914, page 945.)

A number of experimental or test pavements have been laid in this country. The expense usually has been small, as different manufacturers were willing to donate materials. Such tests have the advantage of presenting an ocular demonstration to the taxpayer and the property owner which is more effective than tons of technical literature. Judgment must be exercised, however, in the interpretation of the results of such tests. A material standing first when tested on a street subjected to severe traffic may deteriorate rapidly on a street having a very light traffic.

FOUNDATION

It was learned from the Engineering Department that previous to about three years ago all pavements in Akron were laid on sand, gravel or cinder foundations. This, no doubt, partly accounts for their present condition. The city now realizes that no paving surface will endure unless properly supported.

STREET OPENINGS

The proper paving of a street is simple compared to the difficulty experienced in keeping it paved. A street is no sooner finished than the public utility corporations and the property owners seem to unite in tearing it up.

"In the City of Boston during the year ending January 31, 1910, 13,597 permits were issued for the opening of streets for different purposes, and the length of the openings was 151 miles; this in a total street mileage of 487."

"In the Borough of Manhattan, New York City, in 1911 there were 25,179 openings made of various sizes, in a total street mileage of 440. In the Borough of Brooklyn, New York City, during the year 1911, the Bureau of Highways relaid pavements over trenches made by plumbers and the different corporations of an amount equivalent to seven miles of streets 30 feet wide."*

Akron issued 1490 permits for street openings in 1913. If the average length of these openings is assumed to be the same as those of Boston in 1910, their total length is nearly 17 miles. If the average width of the openings is taken as 3 feet, the total area equals that of a street 30 feet wide and 1.7 miles long, or over 10% of the total new pavement laid in 1913.

Complete prevention is at present impossible, but much can be done to reduce the number of these openings to a minimum. Cincinnati will not lay a pavement until water and sewer mains are provided for and their house connections to each lot made. It also has an ordinance prohibiting the opening of streets for a period of three years after they have been completed. Macon, Georgia, passed an ordinance on April 7, 1914, prohibiting street openings in new pavements for a period of five years from the time

*Street Pavements and Paving Materials, by George W. Tillson, page 589.

the paving is commenced. Akron has no ordinance restricting excavation in streets newly paved.

The repaving of such openings is done by the Street Repair Department and the permittee is charged the actual cost of the labor and materials. In Cincinnati a careful record of cost was kept on the repair of openings in different kinds of pavements and a schedule of prices which include an overhead charge has been issued, based on this data. This enables the property owner or corporation to find out in advance how much his excavation will cost him. See appendix C, page 66.

SUB-SURFACE MAPS

Destruction of pavements can be further reduced by preparing sub-surface maps showing the precise location and character of all structures under the city streets. This is quite a task even now, but every year it grows larger and it is only a question of time when it will have to be done. Brooklyn, New York, and Philadelphia, Pennsylvania, have such maps; Los Angeles, California, is now preparing one, and Cincinnati, Ohio, has taken the first step by compiling the Sewer Record Plats of the city. Such a map will enable the proper department to issue excavation permits intelligently and the data recorded on such maps will not only prevent destruction of property but may avoid loss of life.

Note: For detailed information on New York and Brooklyn Sub-Surface Maps see Street Pavements and Paving Materials, by George W. Tillson, pages 594 to 616.

The Los Angeles underground surveys and records are described in Engineering News, June 4, 1914, page 247.

CONTRACT VERSUS DIRECT METHOD OF CONSTRUCTION

Many public works of various kinds have been successfully constructed by day labor instead of contract, as the

Panama Canal and some of the largest structures built by the United States Reclamation Service. Scores of American cities do all or part of their paving by this method. There are many factors to be considered before adopting one or the other of these methods and each case is usually a problem by itself. Two important questions arise in the case of Akron pavements:

First, which method will furnish pavements at the lowest cost?

Second, which method will furnish the best pavements?

The following table shows the cost of brick pavements in a few cities.

TABLE SHOWING RECENT COST OF BRICK PAVEMENTS IN DIFFERENT CITIES

City	Thickness of Foundation	Grading	Cost per sq. yd.	Remarks
Akron, O.....	4"	not included	\$1.35 to \$1.80 average about \$1.65	Guaranteed 5 yrs. Paid in tax bills which are discounted at from 4% to 7%.
Louisville, Ky	6"	not included	\$1.60 to \$1.70	
Hamilton, O.....	6"	included	\$1.65 to \$1.80	
Dayton, Ohio.....	6"	included	\$1.70	
Kansas City, Mo....	6"	included	Average \$1.87½	
Cleveland, O.....	5" and 6"	not included	\$1.80 to \$2.00	Includes curb, drain, tile, excava- tion, foundation, and wearing surface. Includes excava- ting and curb. The brick costs \$1.10 per sq. yd. f.o.b. St. Paul.
St. Louis, Mo.....	6"	not included	\$1.70 to \$1.80	
Columbus, O.....	6"	not included	\$1.62 Large Cont. \$1.65 Med. Cont. \$1.74 Small Alley Average \$2.83	
Buffalo, N. Y.....	6"	included		
Detroit, Mich.....	6"	included	\$3.30	
St. Paul, Minn.	5"		\$2.40	From 1912 report.
Boston, Mass.....	6"	included	Average \$2.75	
Atlanta, Ga.....	4"	included	\$2.24	
Milwaukee, Wis.....	4"		\$2.00 to \$2.25	
Baltimore, Md.....	6"	not included	\$2.25	
Cincinnati, O.....	6"	included	\$2.00 to \$2.60	
Canton, O.....			\$1.40 to \$1.59	

In Akron many bids have been received this year for constructing cement grouted brick pavements on a 4" concrete foundation, of \$1.50 per square yard. The cost of

brick pavements here is certainly very reasonable and it is questionable whether the city could build these pavements cheaper by day labor.

Mr. S. Whinery, a consulting engineer in New York and a recognized authority upon pavements, points out in his book entitled "Specifications for Street Roadway Pavements" the error in neglecting to properly inspect paving done by the direct, or day's work system. In general, the same precautions are necessary to insure good work by either method. See "Inspection," page 18.

St. Paul, Minnesota, Wilmington, Delaware, Louisville, Kentucky, Holland, Michigan, Boston, Massachusetts, and Atlanta, Georgia, are a few of the cities which pave wholly or in part by the direct method. Duluth, Minnesota, is paving West Superior Street from 15th to 13th Avenues, with vitrified brick on a concrete base, at an estimated cost of \$65,000 by the direct method. A study of methods, organizations and costs in these cities is helpful, but local conditions are most important in deciding which method to adopt.

Mr. J. W. Howard, Consulting Engineer on Pavements, New York, at the eighteenth annual convention of the American Society of Municipal Improvements held at Grand Rapids, Michigan, September 26 to 29, 1911, made the following statement:

"I have advised the City of Washington, in their appropriation for the municipal plant of \$75,000, for the repairs of all kinds of pavements, particularly asphalt there, that a provision be inserted requiring the plant to offer estimates, bids or submissions, at which it, the municipal plant, will pave streets paved for the first time, at the same time the contractors bidding against the municipal plant. The prime reason for that is that it tones up the municipal employes, to show what results they can produce, tabulated by labor, materials and total cost of pavements and maintenance, and pits

them against outside competition. It also prevents, as is done in some cities, the employes of the city department doing desultory and careless work, so that they can do it cheaply."

An editorial on page 917, *Engineering News*, April 23, 1914, calls attention to the increasing interest in the day's work plan evidenced by American cities, pointing out the increase in opposition to the contract plan as one goes westward. The article concludes with this statement:

"Engineers will agree that the question whether any such change in policy is desirable will turn upon the question under what sort of management the day's work plan is to be carried out. *If the work is to be done under a political organization with all that that implies, the taxpayers who pay for the job will be out of the frying pan and into the fire.** On the other hand, wherever a business-like, permanent organization can be established to conduct work it will be an advantage to give any such organization a free hand either to let contracts or to carry on work itself, according to circumstances which may make either plan preferable. In this way the most desirable plan of doing the work should result."

In estimating the probable cost of paving by the direct method, overhead charges must be included. Paving can only be done during about six months of the year, yet a skeleton force of competent foremen and skilled workmen will have to be kept on the payroll continuously if an efficient organization is to be maintained. Machinery and equipment must be bought, stored and maintained and interest and depreciation on these is an important item. The average condition of the labor market here should be given careful consideration to determine the probability of being able to recruit, each year, the force necessary for this work.

*Not in italics in original article.

A comparatively inexpensive test of the direct method could be made by organizing a small force from the present street repair department and allowing them to pave a few blocks in competition with a contractor to whom the remainder of that particular job had been let. In such case, careful cost data and inspection would show the comparative merits of the two methods.

CITY PLANNING

"The art of laying either the nucleus of a new city or the extension of an existing one to the best advantage of its population, as regards economy, beauty and health, both now and in time to come, is, for want of a better term, called Town Planning."*

"The benefits which are sought by a scientific replanning of cities and towns are, broadly, threefold. They lie in a bettering of those circulatory problems that have been created by indirect streets and congested traffic; in the improvement of social conditions in many directions; and in increasing the visible beauty and splendor of cities. Gains are anticipated in economy and efficiency, in comfort, and in looks. * * * To be practical, town planning projects must be reasonable and considerate of all proper interests."†

The first step in the design of any structure is to determine, as nearly as possible, its future use. A pavement is required, first, to accommodate traffic, and unless the amount and kind of this traffic is approximately known, the design of the pavement is mostly guesswork. One of the first steps in City Planning is to take a Traffic Census to ascertain the kind and amount of traffic on the different thoroughfares. Its future trend can be regulated to a large extent by confining factories, residences, etc., to certain districts.

*Opening words from the Preface of the "Transactions," Town Planning Conference. London, 1910.

†The Width and Arrangement of Streets, by Charles Mulford Robinson.

The built-up part of the modern city devotes twenty-five to forty per cent. of its total area to streets. Economy requires that only that portion of this area which is necessary to accommodate the traffic be paved. A Traffic Census would undoubtedly disclose the fact that in the residence districts of Akron the paved widths of streets are from one and one-quarter to one and one-half times as wide as the traffic requires. This unnecessary pavement adds materially to the annual cost and gives the citizen no return.

A City Planning Commission would make a careful study of the prospective paving needs of the city for the next five years and plan a paving program. Property owners could then be advised in advance of prospective assessments and a definite constructive policy be carried out instead of building isolated units by successive administrations. In Cincinnati in 1912 the Council Committee on Streets visited 400 sites of proposed improvements and passed upon the advisability of making the improvement. This method saved the engineering department a great deal of time by eliminating unnecessary estimates. Akron completed 15.75 miles of pavement in 1913. According to the estimate given under Magnitude of the Problem on page 13, 7 miles of streets should be repaved each year in order to keep the 104 miles of pavements now laid in good condition. Under a properly arranged paving program, the repaving of those streets needing it would be cared for before unimproved streets were paved. It is somewhat misleading to call a street "improved" because it was paved fifteen or twenty years ago, when, in its present condition, it is not as passable as when it was a dirt road.

Hartford, Connecticut, Detroit, Michigan, Denver, Colorado, Columbus, Ohio, Los Angeles, California, Topeka, Kansas, Binghamton, N. Y., are a few of the many cities that have done work along these lines.

See "RESOLUTION Amending the Charter of the City of Hartford Concerning a Commission on the City Plan." Appendix E, page 72, and "Extracts from

PLANNING THE CITY," Appendix D, page 68. Further information is contained in the First, Second, Fourth and Sixth Annual Reports of the Hartford Commission on the City Plan; "Modern Cities," by Pollock and Morgan; "The Width and Arrangement of Streets," by Robinson; on file in the Engineering Department of the Municipal University of Akron.

MUNICIPAL REFERENCE LIBRARY

If Akron had a well organized Municipal Reference Library, a large part of the work of this investigation would have been unnecessary. Most of the published data contained and referred to in this report would have been on file therein and accessible to all the officials of the city government.

"It is an agency for the collection and diffusion of information on municipal questions."*

"It is a store-house for municipal facts."*

"It is a clearing house for municipal information."*

"Its purpose is not to reform, but to inform."*

SUMMARY

In view of the facts recorded in this report, it is recommended that the City Council give careful consideration to the advisability of:

1. Authorizing a City Planning Commission.
2. Authorizing a Municipal Reference Library.
3. Determining the cost of engineering and inspection on Akron pavements per dollar of total cost and comparing this cost with that of the new water works and pavements in other cities.

*Taken from a pamphlet issued by the Municipal Reference Bureau of the University of Cincinnati.

4. Supervising street maintenance and repairs by the engineering department.
5. Rewriting all pavement specifications.
6. The payment of a wage to inspectors sufficiently large to attract qualified men.
7. The appointing and supervising of inspectors by the engineering department.
8. Directing the Engineering Department to prepare a pamphlet containing specific instructions to pavement inspectors and the requiring of a detailed daily written report from each inspector.
9. Dividing the city into districts and providing proper pavement inspection for each district.
10. Restricting street openings in new pavements.
11. Starting the preparation of sub-surface maps.
12. Organizing a small force to try out direct method of paving.
13. Employing co-operative students in repair and construction work.
14. Continuing the co-operation with the Municipal University.

HOW THE UNIVERSITY CAN ASSIST

The University can and wishes to be of assistance to the Engineering Department—

1. By furnishing co-operative students who will commence as day laborers in the street repair de-

partment and thus qualify for competent inspectors later in their course.

2. By taking charge of a yearly traffic census.

3. By assisting in the rewriting of the pavement specifications.

4. By co-operating with the Public Library in a Bureau of Municipal Reference.

5. By allowing the city to use its library, equipment and faculty in the solution of its problems.

APPENDIX A

REPORT ON "CONTRACT AND SPECIFICATIONS FOR PAVING, AKRON, OHIO"

PREPARED FOR
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BY THE
NEW YORK BUREAU OF MUNICIPAL RESEARCH
JUNE, 1914

APPENDIX A

GENERAL STATEMENT

Ambiguous wording and poor arrangement make it difficult to obtain a very clear idea of just what the specifications mean. The general provisions are loose and in many cases contradictory. The detailed specifications are so scattered throughout the contracts that it is extremely difficult to determine whether one particular section applies to a stone block, brick, or bituminous pavement.

As an example of poor arrangement, general specifications appear on pages 3, 5, 6, 7, 8, 9, 11, 21, 29, 30, 31, 32, 33 and 38 of the pamphlet all intermingled with detailed specifications and contract provisions. The peculiar use of titles and center captions only increases the confusion. On page 11, under the caption "Old Paving Material," a section (41) has been included which has no relation whatsoever to the question of old paving material.

As examples of poor arrangement of the detailed specifications the following are cited:

- Section 64 —Paving brick
 - " 64a—Paving Blocks
 - " 64b—Common paving stones
 - " 64c—Creosote block
 - " 65 —Samples of materials (general)
 - " 66 —Paving brick

It is obvious that very little care has been taken in the preparation of the specifications. The complete contract and specifications, wholly aside from technical detail, could be materially improved by a rearrangement and by correction of ambiguous expressions. Even the typography is indicative of a general lack of constructive ability or interest on the part of the city officials. Sections 10 and 18 are absolutely meaningless as they stand, due to a printer's mistake.

From the standpoint of official administration, the specifications are also ambiguous. The city civil engineer, the director of public service, and the board of control are assigned rights and powers in such a way that it is impossible to determine which particular city officer is to be the arbiter of the contract provisions. For example, in Section 4, the board of control is made "sole judge of the proper execution of the work and its decision in all cases will be final," but in Sections 9, 10, 27, 28a, and others, the director of public serv-

ice and the city civil engineer are given substantial rights as final arbiters on questions raised during the course of the contract.

The fact that specifications for several different kinds of pavement have been included in one pamphlet and that such detailed specifications are intermingled with general specifications and contract provisions is a serious defect in the form of presentation. On every contract some of these specifications must of necessity be excluded either by crossing out the sections or cutting out the pages, neither of which methods can be commended.

The various elements of contracts and specifications should be assembled in individual groups and each group printed separately in such form that the individual sheets may become pages in an assembled loose-leaf contract. Care should be taken to provide a method for sealing the bound sheets before the assembled contract is formally advertised or executed. The following groups are suggested:

1. General requirements—
 - a—Advertisement
 - b—Instructions to bidders
 - c—General contract provisions
 - d—General specifications
 - e—Bonding and surety requirements and pro forma statements
 - f—Official certification blanks.
2. Pro forma bid sheets and preliminary estimate of quantities.
3. Detailed specifications to be printed separately for each class of work.

DETAILED CRITICISM

GENERAL SPECIFICATIONS

Without a careful study of the laws of Ohio governing contractual relations, it would be impossible to criticize in detail the general specifications included in the present "Contract and Specifications" or to make final recommendations as to the kind of general specifications to be included.

The following criticisms and recommendations are made with this understanding:

Section 7: "Materials are to be of the best quality as measured by the highest standards of the trade." This statement is gen-

eral and hardly applicable to a contract where detailed specifications are required. As an example, it might be deemed advisable on account of cost or delivery reasons to specify Trinidad asphalt or equal, although other types of asphalt are considered superior.

Section 8: From the standpoint of a contractor this is a dangerous provision in any contract. This section seems to give the right to the director of public service to order material changes in construction methods. The danger of this section is also emphasized by the fact that the contractor is required expressly to waive a right for "claims for loss or profits" arising from the changes in specifications or workmanship ordered by the director of public service. In a contract where detailed specifications for workmanship and materials are included it is very doubtful indeed whether a general grant of power to give to any officer the right to make material changes in the specifications included in the proposal for bids would hold in court. This section is also made more ambiguous by the general grant of power given to the board of control in section 4.

This section is also open to question on contracts where the cost is to be assessed against owners of property within a local district. If it be required by the Ohio law, or by local ordinances, that the kind of construction methods to be used be advertised to the prospective assessees in order that a remonstrance may be made before the contract is let, any material departure from original specifications for material and workmanship might make it possible for assessees to avoid payment of the amount of the assessment after the work had been completed.

Section 9: This section provides that where changes in materials and workmanship have been ordered, and where no price has been included in the contract, the price shall be agreed upon before the work is undertaken, and in case an agreement can not be reached the price shall be fixed by the engineer. This seems to be arbitrary and unfair, if, as the section states, such decision shall be final.

Section 3: This kind of section is an open admission on the part of the city officers that the contract specifications will probably not be adapted to the work desired. With proper specifications, such a section is unnecessary. It would be advisable, however, to retain in any contract a clause providing that in case of doubt concerning the contract requirements as to the details of the work the chief engineering officer is to be the final arbiter.

Section 10: This section printed is indicative of the general manner in which the specifications and contract requirements have been prepared. The section consists of one clause of a sentence, and is absolutely meaningless as it stands. After further analysis it appears that lines 3, 4, 5, 6 and 7 of section 18 may belong to sec-

tion 10. As the specifications stand, sections 10 and 18 are absolutely meaningless, and would give a fair basis for breaking any contract by appeal to the courts.

Section 12: It is difficult to understand just why a section of this nature should be included in a paving contract. It seems to be an extract taken from a contract for the construction of sub-structures, probably sewers, in order to obtain the advantage of the final clause which is in black-faced type.

Section 13: This section is entirely too general to be of any advantage in controlling the operation of the contract.

Section 16: It is unquestionably true that a great many things will be encountered in the course of the construction of pavement which do not belong to the city of Akron. The intent of this section is evidently all right; the wording of it, however, is ambiguous.

Section 18: See criticism of section 10.

Section 19: This section is meaningless—"for the entire line of all improvements."

Section 20: Here again the contractor is asked to waive all rights to damages which may be properly due him on account of inefficient service on the part of the city officers.

Section 21: This section is indicative of the poor arrangement already referred to. It is an important element in the instruction to bidders, and on account of this position in the specifications has been picked out in black-faced type.

Section 22: The filing of samples should in no way establish the quality of the material or workmanship to be demanded. The acceptance of filed samples should only authorize the use of such samples as standard.

Section 25: This section seems to be an extract from a specification for curbing or for the furnishing of material where work is to be undertaken by city employees. In its present form it is not adapted to general specifications for a paving contract.

Section 26: This is another example of poor arrangement. This section is practically a reiteration of the thought of section 21 in a little different language.

Section 27: This section contains three detailed provisions:

1. That the work shall not be started without order.
2. That the work shall be carried on in the presence of an official representative of the city and during certain periods.
3. Procedure in the case of abandoning the contract.

The question of procedure in the case of an abandoned contract is entirely one of law and should be given careful consideration from that standpoint.

Section 27a: This section, which includes the guarantee provision, does not seem to differentiate between maintenance repairs and special repairs made necessary by reason of cuts made in the pavement. In fact, the section specifically states that the contractor shall make all special repairs which may become necessary. It would be advisable to include in this section a statement of the amount of deterioration which will be permitted at the end of the guarantee period. This provision should vary for each type of pavement. On sheet asphalt, for example, a wearing of more than one-half inch in depth of the surface or a variation of more than three-eighths of an inch in a four-foot straightedge caused by bunches or depressions should automatically require the repaving of that particular area before the contractor is released from the guarantee provisions.

It would be advisable to include a special section which would clearly define the procedure for restoring cuts made in the pavements by virtue of street opening permits issued by the city.

It would also be advisable to include a statement that the guarantee is to hold irrespective of changes in traffic conditions during the guarantee period, and also to provide procedure for controlling maintenance repairs when necessary. In case the contractor refuses to keep the pavement in repair the city should have the right to do the work and charge the cost of the same against the retained payment or to collect from the sureties.

Section 28a: It often happens that the time limit on a contract seriously affects the amount of the bid. This section permits every contractor to determine for himself the time within which the contract is to be completed. With such a procedure in bidding, it would be difficult indeed to equate in the amounts bid the value of a month's less time in completing the work.

Every proposal for bids should include an exact statement of the time which will be allowed for the completion of the work and the approximate date when the work will be ordered started. The general contract provisions should also include a statement of liquidated damages which will automatically accrue to the city in case of delay in completion of the work.

Section 29: This section is a general grant of power to the director of public service. If it is necessary to carry on work at night, such a statement should be made a part of the contract. Leaving the decision in this matter to one officer is a dangerous proceeding.

Section 30: This section is a heterogenous mixture of procedure for a final estimate of the work done, procedure during the guarantee period and special specifications. The last paragraph should be made a part of the guarantee section. The second paragraph is

hardly necessary, if the general contract provisions provide that, before the actual acceptance of the work upon the completion of the contract, the work and materials conform with the contract and specifications.

Section 28: There is no question that a retained payment during the guarantee period is a better protection to the city than a bond, but provisions should be made for payments of certain amounts retained during the course of the guarantee. This section seems to be somewhat ambiguous when read in connection with section 85.

It is presumed that the last five lines on page 9 should in reality become the first five lines. Criticism of this section was based on such presumption.

Section 83. This section in limiting the power of the inspector on the work so that the inspector shall "have no power to approve material or work, or to order additional work," nullifies to a great degree the value of the inspection unless it be clearly understood that the inspector shall have the right to reject poor material and to stop poor workmanship.

Section 87: This section should be amalgamated with abandonment provisions of section 27 and carefully considered from a legal standpoint.

IMPORTANT OMISSIONS

Without a thorough investigation of local conditions, it would be impossible to point out all omissions from the present contract specifications. It is obvious, however, that, for a city the size of Akron, paving specifications would be incomplete unless specifications be included for

1. Sheet asphalt
2. Bituminous concrete (mixing method)
3. Single course concrete pavement
4. Bituminous surface treatments.

The specifications also fail to require the use of a stone header as an abutment where one pavement joins pavement of another type on an unimproved road. The header construction is of particular importance in preventing the ravelling of pavement wings and marginal strips.

EXCAVATION

Section 35: This is evidently inconsistent with section 32. With proper designation of dumping ground, and with sufficient time given to prospective bidders to inspect the line of work, there is no need for a special price to be included in the contract for hauling for distances greater than 1000 feet.

Section 41: This section is evidently superfluous, at least it should be combined with the provisions of section 35.

Section 45: The need for a layer of sand to be placed upon the sub-grade before the foundation for the pavement is laid will depend entirely upon the condition of the soil. It would seem to be doubtful whether in every case it would be necessary to spread a course of sand on the sub-grade before the foundation is laid.

The term "ballasting" is obsolete as applied to concrete. All concrete work where needed should be included in a separate item for concrete foundation work and bid for upon a cubic-yard basis.

Section 47: This section is ambiguous if read in connection with section 44. In the former section the city offers to do any necessary rolling, with the implication at least that such rolling is to be done free of charge. In the latter section two cents per square yard is to be charged the contractor. If it is necessary for the city to furnish a steam roller for the contractor, the actual cost of this work should be charged against the contract and deducted from the payments due the contractor. In section 44 the statement is made that "all foundations, sub-base and ballast will be rolled by the city." In section 47 the statement is made that "all rolling will be done by the contractor at the price bid per square yard." The contradiction is obvious.

CONCRETE BALLAST

The entire specifications included under the heads "concrete ballast," "cement," and "sand" and "concrete stone" should be supplanted by standard specifications for concrete work. Detail specifications for this work have been prepared by the Association for Standardizing Paving Specifications, the National Association of Cement Users, and the American Society for Testing Materials. Special reports on the detail of concrete specifications have also been prepared for the American Society of Civil Engineers' "Report of Committee on Uniform Tests of Cement" and for the Society for Chemical Industry, "Committee on Uniformity and Technical Analysis for Limestone, Raw Mixtures and Portland Cements."

Section 48: This section evidently refers to the concrete foundation where such a foundation is to be required. The specifications

are meager and very loose. It would be advisable to establish separate loose-leaf specifications for concrete foundation work to take the place of sections 48 to 56 inclusive of the present specifications.

For ordinary foundation work a mix of 1-3-6 has been found to answer all requirements. The present specifications call for a mix of 1-2 1/2-5. This section also states that the cement and sand, after being thoroughly mixed dry, shall be made into mortar "*as hereinafter specified.*" There is no further specification included in any of the following sections which would control the method to be used.

CEMENT

See criticism of concrete ballast.

Sections 53 and 54: The strength tests imposed in these sections are from 25 to 50 pounds lower than the standard.

NEW CURBING

Section 57: The specifications included in this section will no doubt provide an excellent grade of stone. These specifications are open to criticism, however, on the method of placing the curbing. It has been proved too often to be open to any doubt that along permanent construction curbing should be set in concrete. Standard sections for this kind of work should be prepared and included in every contract where stone curbing is to be placed.

COMBINED CONCRETE CURB AND GUTTER

Section 58: It is difficult to criticize these specifications in detail on account of the fact that they refer specifically to "plans on file at the chief engineer's office." Generally speaking, these specifications are open to criticism on the same grounds as the cement concrete foundation specifications just discussed. Much of the detail now included could be eliminated if proper plans were prepared before the contract was advertised. The last three paragraphs of section 54 are examples of the kind of specifications which can be made much clearer by the preparation of proper plans and profiles.

The last paragraph of this section refers generally to the type of Portland cement. Cement specifications are practically standard all over the country, and copies of these specifications are available from any one of a number of sources in addition to those already listed in this article under the heading "Concrete Ballast." Specifications for cement should be printed separately and included in every contract where Portland cement is to be used, no matter for what purpose.

The method of excavation and the amount and kind of drain will have to depend entirely upon local conditions.

CONCRETE CURB

See criticism of combined concrete curb and gutter.

MATERIAL DELIVERED

Section 63: This section should be included in the general specifications, and in so far as it affects the non-obstruction of fire hydrants it should be made more specific.

PAVING BRICK

The specifications for brick pavement are included in sections 64 and 65 to 73 inclusive. Interpolated between sections 64 and 65 are complete specifications for paving blocks and paving stones, creosote block paving, and creosoted wood block wearing service. It is obvious that such an arrangement of specifications is confusing and tends to increase already ambiguous statements.

Section 64: This section is a general introductory statement, but it is open to criticism on the grounds that detailed dimensions for the blocks have not been included. The single specification that the brick shall not be less than four inches in depth opens the specifications to both the "paving brick" and the "brick paving block," the standard size of the former being two and one-half inches in width and eight and one-half inches in length, and of the latter three and one-half in width and eight and one-half in length. This section also fails in not specifying that raised lugs on one side of the brick not to exceed one-quarter of an inch in height or wire cut lugs shall be used. The quality of the brick should be determined by standard tests and not by the judgment of the director of public service.

Section 66: This section refers to the method of testing bricks and refers to the proceedings of the Association for Standardizing Paving Specifications (1912 proceedings). It is of importance to know that the 22 per cent. maximum loss in the standard rattler test was specifically excluded in the proceedings of this society from the "brick size."

Section 67: This section, which outlines the general inspection procedure, could be improved by the specific statement of what shall constitute certain defects which would cause the rejection of the brick, i.e., kiln marks should not exceed three-sixteenths of an inch, and one edge should be clear.

Section 68: The specifications for workmanship included in this section are entirely too meager. The manner for using the template and guide timbers and the method of shaping the cushion have been entirely overlooked. It is implied that the cushion shall be two inches in depth. The best practice in laying paving brick has proved that a one and one-half inch depth of cushion after rolling is sufficient.

The particularly important factor in the method of laying bricks along street railway tracks has evidently been omitted from this section. Particular care should be taken to podge the slot in the rail formed by the head and flange with a strong cement concrete in order that the brick next to the rail will have a firm abutment along the full vertical dimension.

WOOD BLOCK

The specifications for wood block are generally superior to the specifications for the other pavements.

Section 64c (1): The use of a sand cushion for wood block pavement is rapidly being discarded. It is suggested that this method be eliminated from the specifications.

Section 64c (3): One-third of an inch variation in depth and thickness is too liberal an allowance. One-sixteenth of an inch variation in depth would be sufficient. An additional specification providing that all blocks laid in one city block shall not vary more than one-eighth of an inch either way in width or one inch either way in length within the limits stated would improve the specifications.

The provision that each block shall have at least 66 per cent. heart wood should be changed to specify 80 per cent. average heart wood.

Section 64c (4): The intent of this section is satisfactory. The wording could be improved by using the United States Department of Agriculture's Division of Forestry's description of type of timber, and the "Interstate Rules of 1905" definition of prime timber. If in the blank on the top of page 18 the words "long leaf" are not inserted, the meaning is contradictory to the specification of section 64c (3).

Section 64c (5): Vacuum of not less than 22 or 23 inches (Hg.) would be better than 20 inches. A pressure of 200 pounds per square inch is 30 to 35 pounds too high if approximately but 15 pounds of oil per cubic foot of timber is to be used. The amount of oil to be used per cubic foot of timber is not set out in the specifications. An average impregnation of from 15 to 18 pounds of oil per cubic foot would be sufficient.

It would be advisable to vary the detailed specifications as to the methods to be used for impregnating the blocks according to the specific gravity of the wood used.

Section 64c (6): Specifications requiring that oil shall be a distillate obtained wholly from coal tar have been subject to serious criticism on account of the fact that high specific gravity creosote oil was controlled almost entirely by the company controlling the Otto-Hoffman and Semet-Solvay processes of coke manufacture. In order to open the specifications to competition, the specification requiring that only a coal tar product be used has been changed so that the contractor is required to use only 75 per cent. pure coal tar product.

The distillate test at the 315 degree Centigrade position could better be made 50 per cent. with the condition that the fraction distilling between 235 and 315 degrees Centigrade shall have a specific gravity of not less than 1.03 at 38 degrees Centigrade.

Section 64c (7): The same requirement regarding the "podging" of the street railway rails where wood blocks are being laid should hold as in the case of brick pavements.

Section 65: This section should be made a part of the general specifications and should require that the contractor submit samples on or before the date when bids are to be opened.

CEMENT PAVEMENT

Section 73a: It is an open question which of the two concrete pavements, the single concrete or the two-course pavement, is the better. The specification provides for an eight-inch, two-course concrete pavement, of which the first course shall consist of six inches and the second course of two inches.

Without entering into a discussion of the comparative advantages of the two different types of concrete pavements, which has not as yet been satisfactorily settled, it should be said that the specification for the two-course pavement could be improved by the inclusion of more detail as to measuring and mixing, and the methods of workmanship.

No provision has been included for the protection of expansion joints by steel armor. The distance between expansion joints should also be varied according to the width of the roadway.

No provision has been included for the sprinkling of the concrete during setting. One of the most important elements in successful concrete paving work is to keep the surface damp during the set.

SPECIFICATIONS FOR BITUMINOUS MACADAM PAVEMENTS

This specification provides for the construction of (1) a water-bound macadam road approximately six inches in depth, and (2) a bituminous macadam (penetration method) of approximately three inches. The specifications for the water-bound macadam construction will undoubtedly provide an excellent pavement of that character. The detail as to depth, kind of stone, and amount of work will have to be afforded according to the conditions along the route upon which the work is to be done.

The penetration method of constructing bituminous macadam surface depends for success more upon the method of workmanship than upon the kind of materials used. The specifications as given are standard for this type of construction. It is unquestionably true, however, that the penetration method is a dangerous method to use in constructing a bituminous road unless the contractor is experienced in handling the material, and the sub-grade and macadam foundation are in excellent condition.

CEMENT SIDEWALKS

The specifications included for cement sidewalk construction are practically standard for this work.

CLEANING STREET AND CATCH BASINS

Section 74: This section should be made a part of the general specifications.

THE PRICE

Section 75: This section is evidently a general specification applicable to brick pavement construction with proper contract provisions and detailed specifications. This section would seem to be superfluous.

SETTLEMENTS, DEFECTS OR DAMAGES

Section 76: This section in its present position would apply to all kinds of pavements, but it is too stringent for determining the reparable areas at the end of a five-year guarantee period on most types of pavement. A depression exceeding one-half inch as shown by a "ten-foot straightedge," is too stringent a requirement. Three-eighths of an inch on a four-foot straightedge for monolithic pavement would be preferable.

CATCH BASINS

Sections 77 and 78: Specifications for this kind of construction should invariably be made on blue-print, showing plan and profile of the proposed work.

CATCH BASIN COVERS

See criticism of sections 77 and 78.

CATCH BASIN PIPE

Section 80a: This is evidently an excerpt from a sewer specification. This work should be carried on as a separate contract.

MANHOLE AND FLUSH HOLE CAPS AND COVERS

Section 81: See criticism of sections 77-78.

STREET RAILROAD TRACKS

Section 82: This section provides that the space below the upper tram of the street railway rails "shall be cemented or filled flush with the outer edge with cement mortar made of Portland cement one part, sand two parts, tar or asphalt filler." The entire advantage of this section is lost by the inclusion of optional methods permitting the contractor to fill the rail space with tar or asphaltic binder. It should invariably be required that the rails be filled with a Portland cement mortar.

PAVING BLOCKS

Section 64a: This section contains specifications calling for the old type of Medina sandstone block, a kind of paving block which has been discarded by progressive highway engineers for a number of years. There are several fundamental defects in this kind of paving stone. The blocks, as specified, are too long and too thick. The variation in depth permitted necessitates the use of at least two inches, if not three inches, of sand cushion, if the blocks are to be set on concrete.

It is suggested for serious consideration that this specification be entirely eliminated. If it be thought desirable to use a stone block pavement, and if the traffic needs of certain of the heavily traveled streets of the city of Akron would warrant a stone block pavement, improved specifications should be substituted. The maximum length of the block should be decreased to ten inches, the maximum width to four and one-half inches, and the depth should

be made standard at five inches, permitting a maximum variation of not to exceed one-half inch in each dimension.

Moreover, it should be specifically stated that the blocks are to be rectangular in shape. According to the specifications now in use, the Medina blocks may have a bottom area of only three-fourths of the top area. The difficulties encountered in a stone block pavement constructed with this kind of block have been published so often that it hardly seems necessary to criticise in detail this type of block.

All stone block pavement should be set on a concrete foundation, and if laid in that manner and with proper specifications, they will provide an excellent pavement of more lasting quality than any other type of pavement. It is a question, however, whether the traffic conditions on any of the streets in Akron would warrant the construction of this kind of pavement. The cost would be probably from \$3.25 to \$3.50 a yard, including a six-inch concrete foundation and a one-inch sand cushion.

COMMON PAVING STONE

Section 64b: The only difference between the paving block specification and the common paving stone specification is that the latter is even more loose than the former. This section should be eliminated from the specifications. It is wholly unadapted for securing a modern, efficient, stone block pavement.

APPENDIX B

AMERICAN SOCIETY OF CIVIL ENGINEERS

List of Articles on CITY PAVING MATERIALS

From search made by the Library of the Society, April 3, 1914.

NOTE: This is not a complete bibliography; it includes references to periodicals for the years 1911-1913 and books 1911-1913 on manufacture of paving materials.

GENERAL

"A Review of Chicago Paving Practice," by P. E. Green, Assoc. M. Amer. Soc. C. E. Transactions of American Society of Civil Engineers, v. 66, page 1. (Paper No. 1131, March, 1910.) (Data on quality of the brick and specifications for creosoting wood block for Chicago pavements.)

"Text Book on Highway Engineering," pages 503, 530, 550; by Arthur H. Blanchard, M. American Society of Civil Engineers, and Henry B. Drowne, Assoc. M. American Society of Civil Engineers, N. Y., 1913. John Wiley & Sons, 432 Fourth Avenue, \$4.50.

"Pavement Requirements in Ottawa." Canadian Engineer, v. 25, p. 874. (December 18, 1913.) Three pages.

"Bituminous Concrete Pavements," by Wm. B. Spencer. Journal of the American Society of Engineering Contractors, v. 5, p. 173 (June, 1913). (Gives Topeka specifications for bituminous concrete pavement and a digest specifications for sheet asphalt pavement as recommended by the American Society of Municipal Improvement; thirteen pages.)

"The Chevy Chase Experimental Road." Municipal Engineering, v. 45, p. 511 (December, 1913). (Comparative test of bituminous binders and of bituminous concrete, cement concrete, oil-cement concrete, vitrified brick pavements, etc.; four pages.)

"The Construction of Concrete Pavements," by A. M. Comp-ton. Cement and Engineering News, v. 24, p. 288 (October, 1912). (Gives details of concrete and reinforced concrete pavement as used in Davenport, Iowa.)

"Some Recent Improvements in Street Pavements," by G. W. Tillson. Proceedings, Engineers' Club of Philadelphia, v. 29, p. 183 (July 1912). (Discusses materials for paving streets.)

"Considerations Affecting the Selection of Types of Pavements Best Adapted for Use Upon a Given Street." Engineering and Contracting, v. 36, p. 657 (December 20, 1911). (Three pages.)

"Some Recent Improvements in Pavement Construction," by Leonard S. Smith. Wisconsin Engineer, v. 16, p. 360 (March, 1912). (Discusses materials for brick, granite block and bituminous concrete pavement; eleven pages.)

"Concrete Roads and Pavements," by E. S. Hanson. Chicago, 1913. Cement Era Publishing Company. \$1.00. (Contains data on concrete and reinforced concrete pavements for city streets.)

"Specifications for Street Roadway Pavements," by S. Whinery. Second edition. New York, 1913. McGraw-Hill Book Co., 239 W. 39th Street. \$1.00.

BITUMINOUS MATERIALS

"History of Fifth Avenue Asphalt Pavement, New York," by Clifford Richardson. Engineering Record, v. 67, p. 18. January 4, 1913. (Four columns.)

"Paving in Salt Lake City," by D. H. Blossom. Journal, Association of Engineering Societies, v. 50, p. 269. June, 1913. (Ten and a half pages, illustrated.)

"Asphaltic Concrete as a Paving Material for Residence Streets, Suburban Districts and Boulevards," by Linn White. Journal Association of Engineering Societies, v. 50, p. 269. June, 1913. (Ten pages.)

Abstract of same. "Asphaltic Concrete as a Paving Material," by Linn White. Canadian Engineer, v. 25, p. 272. August 7, 1913.

"The Rock Asphalt Pavements of Lawrence, Oklahoma," by Frank B. King. Engineering and Contracting, v. 39, p. 485. April 30, 1911. (Gives specifications and description of work, one page, illustrated.)

"Method and Cost of Asphaltic-Macadam Construction on the Boulevard System of Kansas City, Missouri," by C. W. Redpath. Engineering and Contracting, v. 39, p. 566. May 31, 1913. (Illustrated description of methods and results, with costs.)

"Asphalt Paving Cements and Road Binders," by J. W. Howard. Engineering Record, v. 68, p. 345. September 27, 1913. (States the necessary qualities and gives laboratory methods for determining them; two and a quarter pages.)

"Asphaltic Concrete and Sheet Asphalt Pavements." Canadian Engineer, v. 24, p. 350. February 20, 1913. (Gives specifications adopted by Vancouver, B. C.; two and a half pages.)

"Standard Tests for Asphalt Cements for Sheet Asphalt Pavements," by J. W. Howard. Proceedings American Society of Municipal Improvements, v. 18, p. 102, 1911. (Eight pages.)

Abstract of same. Municipal Engineering, v. 41, p. 342. November, 1911.

"Cost of Constructing and Maintaining Petrolithic Roads and Streets, Together with Data on Other Liquid Asphalt Roads," by K. F. Postle. Engineering and Contracting, v. 37, p. 492. May 1, 1912. (Information concerning roads in California; two pages.)

"Specifications for Asphaltic Concrete and for Sheet Asphalt Pavements, Vancouver, B. C." Engineering News, v. 68, p. 770. October 24, 1912. (Gives specifications adopted in May, 1912; two pages.)

"Street and Railway Track Paving with Asphalt Block in a Suburban Town," by Frank Chappell. Transactions Canadian Society of Civil Engineers, v. 27, p. 118. 1913. (Explains condition in the town of Oshawa and describes the construction of asphalt block pavement on a concrete base; five pages.)

"Maintenance of Asphalt Pavements," by Francis P. Smith. Municipal Journal, v. 34, p. 679, 712. May 15, 22, 1913. (Four pages.)

"Asphalt Macadam Construction at Carlisle, Pa." by C. A. Bingham, Associate Member American Society of Civil Engineers. Engineering and Contracting, v. 36, p. 653. December 20, 1911. (One page, illustrated.)

"Methods and Cost of Constructing a Petrolithic Pavement in Cudahy City, California," by C. G. Varcoe. Engineering and Contracting, v. 41, p. 126. January 28, 1914. (The oil used was one containing about seventy-five per cent. asphalt; one page.)

"Asphalt Construction for Pavements and Highways," by Clifford Richardson. New York, 1913. McGraw-Hill Book Co., 239 W. 39th Street. \$2.00.

"Bituminous Concrete Pavements," by H. G. Lyken. Proceedings of the American Society of Municipal Improvements, v. 18, p. 60. 1911. (Thirty-four pages.)

"Bituminous Gravel Concrete Pavements," by J. W. Howard. Municipal Journal, v. 34, p. 851. June 19, 1913. (Reasons for failure of such road surfaces, clay film on gravel and poorly graded sizes; one page, illustrated.)

"The Consistency of Bituminous Material, Its Determination and Value in Specifications." *Engineering and Contracting*, v. 39, p. 152. February 5, 1913. (A discussion of the significance and viscosity of bituminous materials for road work; two and a half pages.)

"Fixed Carbon in Bituminous Materials, Its Determination and Value in Specifications," by Lester Kirschbraun. *Engineering and Contracting*, v. 39, p. 172. February 12, 1913. (Two and a half pages, with diagrams.)

"Bitumen in Modern Pavements," by J. B. Temple. *Applied Science*, v. 7, pp. 30, 59. November, December, 1912. (Eighteen pages.)

"A Review of the Use of Bituminous Materials in the Construction and Maintenance of Highways During 1911," by Arthur H. Blanchard. *Engineering and Contracting*, v. 37, p. 605. May 29, 1912. (Two pages.)

"Bituminous Roads and Pavements, and Their Materials of Construction," by Prevost Hubbard. *Journal of the Franklin Institute*, v. 173, p. 343. April, 1912. (Discusses some of the fundamental principles, the selection of materials, methods of construction, etc.; twenty-one pages.)

"The Park Heights Experimental Road, Baltimore, Md.," by D. M. Avey. *Municipal Engineering*, v. 42, p. 83. February, 1912. (Contains data on several road materials; six pages.)

"Bituminous Road Construction." *Municipal Journal*, v. 33, p. 440. September 26, 1912. (On the use of bituminous pavement in Boston; three pages, illustrated.)

"History of the Bituminous-Concrete Pavements," by Mark Brooke. *Engineering Record*, v. 65, p. 132. February 3, 1912.

"Value of Melting Point Tests of Bituminous Materials," by H. B. Pullar, Associate Member American Society of Civil Engineers. *Canadian Engineer*, v. 26, p. 211. January 22, 1914. (One and three-quarter pages.)

"The Relative Economy of Constructing Bituminous Pavements by Penetration Methods," by George C. Warren. *Municipal Engineering*, v. 46, p. 146. February, 1914. (Five and a half pages, with illustrations of the streets of Boston.)

"Methods and Costs of Constructing the Byberry and Bensalem Service Test Road, Philadelphia, Pa." *Engineering and Contracting*, v. 41, p. 83. January 14, 1914. (Seven and a half pages.)

"The Use of Bitumens for Roads," by Arthur H. Blanchard. *Municipal Journal*, v. 32, p. 750. May 16, 1912. (Contains brief reference to materials for pavements in Washington, D. C., and in Borough of Richmond, New York City.)

"Characteristics of Bituminous Highway Materials (Letter)," by Clifford Richardson. *Municipal Engineering*, v. 42, p. 41. January, 1912. (Two pages.)

"Bituminous Road Construction." *Municipal Journal*, v. 33, p. 440. September 26, 1912. (Gives details of pavements in Boston.)

"The History of the Washington Bituminous Concrete Pavements," by Mark Brooke. *Engineering Record*, v. 65, p. 132. February 3, 1912. (One and a half pages.)

"Bitucrete Pavement," by A. E. Schutte. *Municipal Engineering*, v. 42, p. 233. April, 1912. (Test pavements were laid at Cambridge and at Newton, Mass., and at Morristown, New Jersey; two and a half pages.)

"Queens Borough Experimental Road." *Municipal Journal*, v. 33, p. 435. September 26, 1912. (Methods of laying nine different mixtures and condition of each after one year's service, oil concrete, bituminous concrete and bituminous macadam, details of specifications; four pages, illustrated.)

"History of Tar-Concrete Pavements in Ontario." *Engineering and Contracting*, v. 37, p. 14. January 3, 1912. (Data on pavements in the cities of Hamilton, Toronto, London, Guelph, Ottawa and Chatham; two pages.)

"Discussion on Bituminous Materials for Road Construction," by W. H. F. Iweller, Sanford E. Thompson and Prevost Hubbard. *Proceedings of American Society of Civil Engineers*, v. 40, p. 389. February, 1914. (Discussion of report of the Special Committee on Bituminous Materials for Road Construction for 1913; seven and a half pages.)

"Road Construction and Maintenance, Use of Bituminous Material in Penetration and Mixing Methods." (An informal discussion.) *Transactions American Society of Civil Engineers*, v. 75, p. 572, Paper 1226. December, 1912. (Seventy-seven pages, illustrated.)

"Road Construction and Maintenance; an Informal Discussion." *Transactions American Society of Civil Engineers*, v. 73, pp. 74, 99, Paper 1194. September, 1911. (On the use of bituminous materials by penetration methods and by mixing methods; twenty-six pages.)

BRICK

"Experiments in Brick Road Construction," by James T. Voshell. *Engineering Record*, v. 68, p. 347. September 27, 1913. (Test data, physical properties of brick and costs of section containing fourteen varieties of paving brick; one and a half pages.)

"Prevention of Defects in Brick Pavements." Municipal Engineering, v. 44, p. 96. February, 1913. (Illustrated discussion of defects in brick pavements, their causes and prevention; six pages, illustrated.)

"The Testing of Vitrified Paving Brick," by W. P. Bloecher. Wisconsin Engineer, v. 17, p. 78. November, 1912. (A review of tests for paving brick, give no actual results of tests; four pages.)

"Specifications for Brick Pavements." Proceedings of the American Society of Municipal Improvements, 1912, p. 200. Balt., 1913. C. C. Brown, Secretary, Indianapolis, Ind. (Contains eight pages on the character of the brick, tests, etc.)

"Testing Pavements in Detroit," by J. C. McCabe. Proceedings American Society Municipal Improvements, 1912, p. 185. (Data on the kind of brick used, methods of testing and results; eight pages, illustrated.)

"Thermal Effects on Cement-Filled Brick Pavements," by Jas. E. Howard. Proceedings American Society Municipal Improvements, 1912, p. 156. (Data on physical properties of vitrified paving brick and effect on cement-filled brick pavements of changes in temperature.)

"Wire-Cut Lug Paving Blocks," by F. B. Marsh. Engineering Record, v. 68, p. 37. July 12, 1913. (Machine for cutting wire-cut lug block, advantages of wire-cut lug block and results of rattler test; four columns, illustrated.)

"Strain Measurements of Brick Pavements," by James E. Howard. Municipal Journal and Engineer, v. 32, p. 511. April 4, 1912. (Physical tests of brick pavements; two and a half pages, illustrated.)

"The Function of Time in the Vitrification of Clays," by G. H. Brown and G. A. Murray. Technologic Papers of the Bureau of Standards, No. 17. Washington, 1913. S. W. Stratton, Director. (Description of work and discussion of results on paving-brick shale; twenty-three and a half pages with diagrams.)

"Dehydration of Clays," by G. H. Brown and E. T. Montgomery, Technologic Papers of the Bureau of Standards, No. 21. Washington, 1913. (Includes tests on a paving brick shale from Galesburg, Ill.; twenty pages, with diagrams.)

"Effect of Overfiring Upon the Structure of Clays," by A. U. Bleininger and E. T. Montgomery. Technologic Papers of the Bureau of Standards, No. 22. Washington, 1913. (States that from a practical standpoint this question concerns chiefly dense products like paving block, etc.; results of tests; twenty-one pages.)

"American Society for Testing Materials, Proposed Standard Specifications for Paving Brick." Proceedings American Society for Testing Materials, v. 13, p. 289. 1913. Edgar Marburg, Secretary University of Pennsylvania, Philadelphia, Pa. (Thirteen pages, illustrated.)

"A Study of the Rattler Test for Paving Brick," by M. W. Blair and Edward Orton, Jr. Proceedings American Society for Testing Materials, v. 11, p. 776. 1911. (Thirty-eight and a half pages, illustrated.)

Reprint of same. Ohio State University, College of Engineering, Bulletin No. 3. November, 1911. Columbus, O., 1911.

"Temperature Strains in Brick Pavements," by James E. Howard. Municipal Engineering, v. 43, p. 381. December, 1912. (On investigation made by the United States Bureau of Standards; three pages, illustrated.)

"Relative Advantage of Laying Brick Pavements on Sand Foundations and Cement Concrete Foundations." Engineering and Contracting, v. 39, p. 226. February 26, 1913. (Four-inch and five-inch bricks were used; one and a half pages, with diagrams.)

"Standardization of the Rattler Test," by M. W. Blair. Proceedings Indiana Engineering Society, v. 31, p. 148. 1911. Nine pages.)

Abstract of same. Municipal Engineering, v. 40, p. 91. February, 1911.

Street Pavements and Paving Materials," p. 91, by Geo. W. Tillson. Second edition. New York, 1912. John Wiley & Sons, 432 Fourth Avenue. \$4.00 net. (Contains a chapter on brick-clays and the manufacture of paving brick; fourteen pages.)

"Some Observations on the Qualities of Paving Bricks," by Edward Orton, Jr. Ohio State University, College of Engineering, Bulletin No. 1. September, 1911. (Results of Investigations; twenty-eight pages.)

"Modern Brickmaking," p. 369, by Alfred B. Searle. London, 1911. Scott Greenwood & Son. (A general treatise on brickmaking; contains two pages on manufacturing paving brick.)

"Treatise on Roads and Pavements," p. 465, by Ira Osborn Baker, Member American Society Civil Engineers. Second edition. New York, 1913. John Wiley & Sons, Inc., 432 Fourth Avenue. (Contains six pages on manufacture of paving brick.)

"New Standard Brick Rattler, Recommended by National Paving Brick Manufacturers' Association." Municipal Journal and Engineer, v. 30, p. 353. March 15, 1911. (One page.)

"Pavement Construction with Bricks Laid Flatwise or with the Fiber in a Vertical Position," by James T. Tucker. *Engineering Contracting*, v. 40, p. 585. November 19, 1913. (Four columns, illustrated.)

CONCRETE

"Brantford Concrete Pavements," by T. Harry Jones. *Canadian Engineer*, v. 23, p. 829. December 5, 1912. (Illustrated detailed description of concrete pavements; two pages.)

"Concrete Pavement in Davenport and Vicinity," by A. M. Compton. *Concrete-Cement Age*, v. 1. December, 1912, p. 78. (An account of the concrete pavements laid and the specifications used; one page.)

"Chevy Chase Experimental Concrete Road." *Engineering Record*, v. 67, p. 719. June 28, 1913. (Illustrates and describes bituminous, oil-cement and plain-cement concrete highway pavement laid near Washington, D. C.; one and a half pages.)

"Plain Concrete Paving Used in Kansas City, Missouri," by Clark R. Mandigo. *Engineering News*, v. 70, p. 112. July 17, 1913. (Describes the construction of these pavements and comments on the wear and utility; four pages, illustrated.)

"Concrete Pavements in Greenville," by H. N. Baumberger. *Municipal Journal*, v. 32, p. 422. March 21, 1912. (Gives specifications; one page, illustrated.)

"Concrete Paving in Kansas City, Missouri," by Clark R. Mandigo. *Municipal Journal*, v. 32, p. 415. March 21, 1912. (One and a half pages.)

"Concrete Pavement in Sioux City," by Keyes C. Gaynor. *Municipal Journal*, v. 32, p. 420. March 21, 1912. (Specifications; two pages.)

"Concrete Pavement Reports Tabulated from Eighty-Five Places Where Concrete is Used on Streets and Roads." *Concrete-Cement Age*, v. 1, p. 30. September, 1912.

"Tests of Concrete and Brick Pavements, Details of the Types Tested with the 'Determinator' at the American Road Congress in Detroit, and a Statement of the Obvious Results." *Engineering Record*, v. 68, p. 457. October 25, 1913.

"Concrete Roadways," by Lewis R. Ferguson. *Proceedings Engineers' Club of Philadelphia*, v. 31, p. 65. January, 1914. (General discussion includes materials for concrete pavements in cities; twenty-one and a half pages.)

"Standards of Concrete Road Construction; Recommendations as to Specifications, Construction, Maintenance and Costs Offered by Committees at National Conference on Concrete Road Building," *Engineering Record*, v. 69, p. 214. February 21, 1914. (Two and a half pages.)

"Top Dressing for Concrete Pavements in Grand Haven, Michigan." *Cornell Civil Engineer*, v. 22, p. 52. November, 1913. (Report on coating experiments conducted by the W. J. Sherman Co.)

"Concrete Roads, a Careful Inspection of Various Concrete Roads Brings to Light Both Favorable and Unfavorable Data." *Municipal Engineering*, v. 45, p. 408. November, 1913. (Six pages, illustrated.)

"An Improved Concrete Pavement," by E. W. Groves. *Cement and Engineering News*, v. 24, p. 229. August, 1912. (One and three quarter pages.)

"A Review of Concrete Paving Methods in Various Places," by K. H. Talbot. *Concrete-Cement Age*, v. 1, p. 48. October, 1912. (Contains data on materials used.)

Same. "Concrete Pavements, History and Summary of Practice." *Engineering and Contracting*, v. 38, p. 44. July 10, 1912.

"Concrete Pavements at Ann Arbor." *Engineering and Contracting*, v. 38, p. 235. April 27, 1912. (Gives details of construction of pavement; one page.)

"Expansion Joints for Concrete Pavement." *Engineering and Contracting*, v. 38, p. 235. August 28, 1912. (Gives specifications for concrete pavement at Davenport, Iowa.)

"Methods of Constructing Concrete Alley Pavement at Billings, Mont.," by John N. Edy. *Engineering and Contracting*, v. 38, p. 407. October 9, 1912. (One page, illustrated.)

"Some of the Properties of Oil-Mixed Portland Cement Mortar and Concrete," by Logan Waller Page, Member American Society of Civil Engineers. *Transactions American Society of Civil Engineers*, v. 74, pp. 268, 273, 281. Paper 1211. December, 1911. (Gives data on experimental pavements laid with oil-concrete.)

GRANITE BLOCK

"Granite Block Specifications." *Municipal Journal and Engineer*, v. 30, p. 354. March 15, 1911.

"A Text Book on Roads and Pavements," p. 328, by Frederick P. Spalding. Fourth edition. New York, 1912. John Wiley & Sons. (Contains a chapter on stone-block pavements; five pages.)

"Small Granite-Block Pavement in Navy Yard at Brooklyn." *Engineering Record*, v. 68, p. 181. August 16, 1913. (States that this is probably the first pavement to be laid in the United States similar to the Durax block pavement of England or the Kleinpflaster of Germany, includes brief details of method of splitting the stone; one page, illustrated.)

"Les Pavés de Granit de Scandinavie (Suede et Norvege)," by M. Labordere. *Annales des Ponts et Chaussées*, 1913. Pt. 4, p. 18. July-August. (Kinds of stone, methods of procuring it, etc.)

REINFORCED CONCRETE

"Concrete Pavements at Fond du Lac." *Municipal Journal*, v. 31, p. 820. December 28, 1911. (States that most of the pavement laid during 1910-1911 has been reinforced; one page, illustrated.)

"Reinforced Concrete Foundations Over Excavations on Paved Streets," by John McNeal, Member American Society of Civil Engineers. *Transactions American Society of Civil Engineers*, v. 60, p. 217. Paper 1068. June, 1908. (One and a half pages, illustrated.)

"Reinforced Concrete Pavements in St. Johns, Michigan," by E. G. Hulse. *Municipal Engineering*, v. 45, p. 488. November, 1913. (One column.)

"Methods and Time Cost of Reinforced Concrete Pavement Construction at Plymouth, Wisconsin," by W. G. Kirchoffer. *Engineering and Contracting*, v. 40, p. 151. August 6, 1913. (One page, illustrated.)

"Concrete Pavements in Davenport and Vicinity," by A. M. Compton. *Proceedings Iowa Engineering Society*, v. 24, p. 32. 1912. (Contains one page on reinforced concrete pavements.)

Abstract of same. "Concrete Pavements in Davenport," by A. M. Compton. *Engineering Record*, v. 65, p. 483. May 4, 1912. "Construction of Concrete Pavements," by A. M. Compton. *Cement and Engineering News*, v. 24, p. 289. October, 1912.

"Novel Reinforced Concrete Pavements." *Municipal Journal and Engineer*, v. 31, p. 819. December 28, 1911. Woven wire reinforcement was used and cypress strips for expansion joints; one and a half pages, illustrated.)

"A Reinforced Concrete Pavement at Plymouth." *Engineering Record*, v. 64, p. 736. December 23, 1911. (Three-quarters of a page, illustrated.)

"Reinforced Concrete Paving at Port Huron, Michigan," by Earle R. Witmore. Engineering and Contracting, v. 40, p. 62. July 16, 1913. (Two pages, illustrated.)

WOOD BLOCK

"Specifications for Creosoted Wood Block Pavements." Proceedings American Society Municipal Improvements, 1912, p. 226. (Two and a half pages on timber, size of blocks, treatment, oil and inspection.)

"Experiments of French Engineers for Improving the Strength of Wood for Pavements," by P. Labordere and F. Austell. Engineering and Contracting, v. 38, p. 237. August 28, 1912. (Description of experiments and resulting conclusions; one and a half pages.)

"The Testing of Wood Paving Blocks," by F. Kleeberg. Municipal Engineering, v. 42, p. 354. May, 1912. (Information concerning the requirements for such blocks in Manhattan, the tests and experiments made on deliveries and related matters; five pages.)

"City of Lynchburg, Virginia, Standard Specifications for the Construction of Improved Pavements and Appurtenances," p. 29, by H. L. Shaner, City Engineer, Lynchburg, Va. 1912. (Contains specifications for creosoted wood block pavements; six pages.)

"Wood Block Paving in Minneapolis," by Ellis R. Dutton. Municipal Engineering, v. 43, p. 376. December, 1912. (Gives specifications for wood blocks.)

"Strength and Expansion of Creosoted Paving Blocks," by W. K. Hatt. Proceedings Indiana Engineering Society, v. 31, p. 128. 1911. Charles Brossman, Secretary Indianapolis, Ind. (Gives the results of physical tests of paving blocks secured from four different treating plants; sixteen pages, including diagrams.)

"Tests of Creosoted Paving Blocks," by W. K. Hatt. Proceedings Indiana Engineering Society, v. 30, p. 216. 1910. (Six and a half pages, including diagrams.)

"Repaving the 'Loop' District in Chicago with Creosoted Wood Blocks," by William W. Marr, Member American Society Civil Engineers. Engineering News, v. 64, p. 718. December 29, 1910. (Contains specifications for oil used.)

"Creosoted Wood Block Paving in Chicago," by Harry G. Davis. Engineering Contracting, v. 36, p. 276. September 13, 1911. (One and a half pages.)

"A Treatise on Roads and Pavements," p. 549, by Ira Osborn Baker. Second edition. New York, 1913. John Wiley & Sons. (Contains a chapter on wood block pavements, with data on preservation of the wood, preparing the blocks, etc.)

"Two Reports on Paving Materials and Work in Chicago." Engineering News, v. 66, p. 254. August 31, 1911. (Report of the Chicago Bureau of Public Efficiency giving specifications for wood block paving; two columns.)

"Development of Wood Block Specifications," by George W. Tillson. Municipal Journal and Engineer, v. 30, p. 349. March 15, 1911. (History of the use of treated wood blocks in the East, evolution of specifications in New York; two pages.)

"Specifications for Wood Block Paving," by S. Whinery, Member American Society Civil Engineers. Engineering News, v. 65, p. 501. April 27, 1911. (One and a half pages.)

"Notes on Creosoted Wood Block Pavements," by Paul Evans Green, Associate Member American Society of Civil Engineers. Engineering News, v. 65, p. 474. April 20, 1911. (Contains brief details on timber, etc.)

"Nine Years' Experience with Creosoted Wood Block Pavement in Minneapolis," by B. H. Durham. Engineering and Contracting, v. 36, p. 450. April 19, 1911. (Gives results of comparative tests of different woods.)

"European Creosote Specifications for Paving Block for City Streets, Discussion of the Desirability of Reducing Amount of Oil Impregnation," by E. A. Sterling. Engineering Record, v. 67, p. 495. May 3, 1913. (One page.)

"Creosoted Wood Block Pavement Laid by City Day Labor in Minneapolis," by Ellis R. Dutton. Engineering News, v. 69, p. 27. January 2, 1913. (One and a quarter pages.)

"Creosoted Block Paving in Chicago," by John Ericson. Municipal Engineering, v. 44, p. 17. January, 1913. (Discusses the treatment of the blocks; three and a half pages.)

"Practice and Experience with Algarrobo Wood Pavements in Buenos Aires, Argentina." Engineering and Contracting, v. 40, p. 198. August 20, 1913. (Contains brief details of block made with native algarrobo wood.)

"Comparison of the Absorptive and Expansive Properties of Wood Paving Block when Treated with Paving Oil Specific Gravity of 1.12, and Creosote Oil Specific Gravity 1.055," by H. M. Rollins. Proceedings American Wood Preservers' Association, 1912, p. 128. (Gives results of tests; three pages.)

"Street Pavements and Paving Materials," p. 326, 366, by George W. Tillson. Second edition. New York, 1912. John Wiley & Sons. \$4.00 net. (Contains a chapter on wood pavements, including chemical treatment of timber.)

"The New Specifications of the Board of Local Improvements of Chicago, Ill., for Creosote Wood Block Pavement. Engineering and Contracting, v. 38, p. 68. July 17, 1912. (Four columns.)

"Methods and Cost of Constructing a 3" Creosoted Wood Block Pavement at Longview, Texas," by P. E. Green, Associate Member American Society of Civil Engineers. Engineering and Contracting, v. 37, p. 548. May 15, 1912. (Gives characteristics of creosote oil used at Longview, Texas.)

"A Vertical Tank Paving Block Creosoting Plant." Engineering and Contracting, v. 40, p. 606. November 26, 1913. (Two pages, illustrated.)

"Report on Creosoted Wood Block Pavement," by John Ericson, Chicago, Ill., 1911. Department of Public Works. (Report of the City Engineer on specifications for treating wood block.)

"Progress Report on Wood-Paving Experiments in Minneapolis," by Francis M. Bond. United States Forest Service, Circular No. 194. Washington, 1912. Henry S. Graves, Forester. (Experiments to gain information on species of wood, heartwood and sapwood, length of blocks and angle of courses.)

"A Text Book on Roads and Pavements," p. 307, by Frederick P. Spalding. Fourth edition. New York, 1912. John Wiley & Sons. \$2.00 net. (Contains a chapter treating of types of wood block pavement, kinds of wood used, treatment of wood blocks and tests; twenty-six pages, illustrated.)

"Conditions of Use and Construction of Paved Surfaces in the Town of St. Petersburg," by S. K. Vroubevsky. Permanent International Association of Road Congresses, Third Congress. London, 1913. Report No. 34. Paris, 1913. Societe Anonyme des Imprimeries Oberthur. 3 Rue Rossini. (Data on shapes and standard sizes of wood block timber, method of production and cost of preparing the blocks; five pages.)

"Wood Pavements in the United States," by George W. Tillson. Permanent International Association of Roads Congresses. Third Congress. London, 1913. Report No. 30. (Contains four pages on kind of wood, size of blocks and character of preservative and amount to be used.)

"Wood Paving," by L. Mazerolle. Per. International Assoc. of Road Congress, 3rd Congress, London, 1913. Report No. 31. (Thirty-three and a half pages.)

"Wood Paving," by A. Brown, E. C. Mawbey, W. N. Blair and O. E. Winter. Permanent International Association of Roads Congresses. Third Congress. London, 1913. Report No. 32. (Data on choice of woods and suggestions for treating wood blocks; four pages.)

"Budapest Wood Paving," by Rudolf Lappert. Permanent International Association of Road Congresses. Third Congress. London, 1913. Report No. 33. (Contains data on preparation of the blocks, etc.)

"Wood Paving with Special Reference to Work Done in Vienna," by Leopold Kosetschek. Permanent International Association of Road Congresses. Third Congress. London, 1913. Report No. 29. (Five and a half pages on manufacture of the blocks, treatment, etc.)

"Street Pavement Laid in the City of Chicago; an Inquiry Into Paving Materials, Methods and Results," p. 27. Chicago, 1911. (Contains data on creosoted wood block pavement; eleven pages.)

"Heaving of Wood Block Pavement Under Extreme Climatic Conditions." Engineering News, v. 70, p. 1134. December 4, 1913. (Three and a half pages, illustrated.)

"How Nearly Does the Modern Yellow Pine Block Pavement Approach to the Ideal Pavement, and What Improvements Can We Suggest?" by H. L. Collier. Proceedings American Wood Preservers' Association, 1913, p. 336. (Considers the cardinal points of an ideal pavement, and compares the yellow pine block; discussion. 8500 words.)

"Timber for Creosoted Block Paving," by Harry G. Davis. Proceedings American Wood Preservers' Association, 1913, p. 354. (Discusses the essential principles to insure success in this kind of pavement.)

THE FOLLOWING REFERENCES CAN NOT BE VERIFIED, AS PERIODICALS ARE NOT IN THE LIBRARY

"Modern Bituminous Roads and Pavements," by F. C. Ford. Chemical Engineer. July, 1913. (Considers types of construction in which bituminous materials are used.)

"Methods of Bituminous Construction," by S. D. Foster. Contract Record. October 8, 1913. (Considers the penetration method as specified by the Pennsylvania State Highway Department.)

"Huntington Drive," by Ernest F. Ayres. Western Engineering. November, 1913. (Gives itemized costs of this concrete road covered with thin asphaltic oil wearing surface.)

"Bituminous Pavements for City Streets," by George W. Tillson. Proceedings American Road Builders' Association, 1913. (A discussion of the bituminous pavements considered standard today, their construction, maintenance and repair; general discussion; ten thousand words.)

"Chevy Chase Experimental Road." Cement Era. October, 1913. (Illustrated account of this government-built road of different materials laid in various ways, deals especially with concrete construction; eighteen hundred words.)

RECENT ARTICLES ON TRAFFIC CENSUS

(Kindness American Society of Civil Engineers.)

"Street Traffic in New York City, 1885 and 1904," by Clifford Richardson, Associate Member American Society of Civil Engineers. Transactions American Society of Civil Engineers, v. 57, p. 181. Paper 1031. December, 1906.

"Road Construction and Maintenance; an Informal Discussion, January 17 and 18, 1913." Transactions American Society of Civil Engineers, v. 77, p. 144. Paper 1286. 1914. Travel census and units on Park Heights Avenue.

"Traffic Census on Highways," by L. I. Hewes. Engineering Record, v. 67, p. 556. May 17, 1913. (Directions for taking of traffic data in connection with road improvements.)

"The Traffic Census as a Preliminary to Road Improvement," by William D. Schier. Good Roads, v. 5, p. 40. January 4, 1913. (Paper read before the American Good Roads Congress.)

Same. Municipal Journal, v. 34, p. 24. January 2, 1913.

"A Proposed Standard Record of Street Traffic." Engineering News, v. 69, p. 4. January 2, 1913.

"Metropolitan Traffic (Editorial)." Engineering, v. 92, p. 770. December 8, 1911.

"Road Traffic Census," in "Report of the State Commission of Highways, January, 1910," p. 489. Albany, N. Y., 1910.

APPENDIX C

CITY OF CINCINNATI

Engineering Department
F. S. KRUG, Chief Engineer

In Reply, Kindly Refer to File 895 HLC-BS
April 10, 1914.

MR. F. E. AYER,
Municipal University, Akron, Ohio.

Dear Sir:

We are sending you herewith a copy of the restoration work done by the Street and Sewer Repair Department during the year 1913, divided arbitrarily into certain sizes of cuts.

The column headed "Average cost per square yard" contains only the direct cost of labor and material actually applied on the job, as shown by the foremen's reports, which are made out daily and forwarded to the office.

The column headed "Average cost per square yard, overhead included," is the same as the preceding column with the addition of 25% overhead, which represents the difference between the total expenditures of the department and the amount expended directly for labor and material, as shown by the reports of foremen doing the work.

The column headed "Extra material" is material chargeable to the party to whom permit is issued through this material being destroyed or misplaced when cut was made in pavements.

During the year 1913 all new material was used in mixing concrete, none of the old material being used. The price of this concrete varied from \$7.00 in the small cuts to \$6.00 per cubic yard in the larger size.

The prices given in column marked "Average cost per square yard" were arrived at by deducting the cost of the concrete at the above mentioned prices from the total cost, which remainder represented the actual direct cost of restoring pavement surface.

I think this tabulation will enable you to thoroughly understand the basis of the new restoration ordinance, and the resolution of the Director of Public Service, copies of which you saw.

If there is any further information which we can furnish you we shall be very glad to do so at any time.

Yours truly,

F. S. KRUG,
Chief Engineer.

Sq. Yds	Surface Sq. Yds.	Concrete Cu. Yds.	Total Cost	Extra Material	Average cost per sq. yd.	Average cost per sq. yd. overhead included
ASPHALT						
1.....	304.8	63.95	928.51	3.67	1.83	2.29
2.....	502.4	116.69	1396.22		1.68	2.10
4.....	805.9	176.74	1530.07		.67	.84
8.....	354.5	67.83	623.90		.69	.86
12.....	732.1	65.50	885.72		.74	.93
50.....	3784.1	131.15	3385.88		.89	1.11
	6483.8	621.86	8750.30	3.67	.85	1.06
BOWLERS						
1.....	133.1		167.71	3.85	1.23	1.54
2.....	531.4		528.67	14.81	.95	1.21
4.....	279.2		809.17	20.78	.81	1.01
8.....	392.3		193.95	7.52	.67	.84
12.....	621.6		533.95	27.20	.82	1.03
50.....	2297.3		1506.69	52.51	.63	.79
	4834.2		3740.14	126.67	.75	.94
BRICK						
1.....	304.9	41.78	786.81	15.43	1.76	2.20
2.....	816.5	117.29	1691.26	17.63	1.24	1.55
4.....	1066.8	149.17	1860.54	45.51	.92	1.15
8.....	393.2	55.66	612.79	15.13	.73	.91
12.....	700.30	97.38	1078.14	25.26	.78	.98
50.....	5720.3	96.59	5224.20	228.43	.82	1.03
	9001.1	557.87	11253.74	347.39	.89	1.11
GRANITE						
1.....	683.0	55.67	1236.13	18.82	1.38	1.66
2.....	1071.1	146.03	2120.21	33.99	1.20	1.50
4.....	1832.8	238.13	3352.84	51.77	1.07	1.34
8.....	1189.7	135.82	1947.15	43.08	.96	1.10
12.....	3193.3	208.56	3839.75	90.16	.84	1.05
50.....	29202.4	727.53	20547.63	569.95	.56	.70
	37172.3	1511.74	32953.71	802.27	.65	.81
MACADAM						
1.....	344.5		331.65	108.02	.65	.81
2.....	2080.6		1412.61	472.43	.45	.56
4.....	2926.9		1450.38	474.21	.33	.41
8.....	619.9		341.66	76.55	.43	.54
12.....	1127.1		515.33	190.63	.29	.36
50.....	14237.6		3809.83	1110.65	.19	.24
	21336.6		7861.46	2432.49	.25	.31
WOOD BLOCK						
1.....	33.5	8.21	92.58		1.39	1.74
2.....	80.6	13.18	223.18		1.85	2.31
4.....	123.1	24.93	317.20	8.75	1.06	1.33
8.....	77.1	16.79	137.34		.56	.70
12.....	219.1	22.09	377.24	15.05	1.12	1.40
50.....	1419.0		1632.88	44.00	1.12	1.40
	1952.4	85.20	2780.42	67.80	1.18	1.48
BITUMINOUS MACADAM (Penetration)						
1.....	54.		88.96	18.76	1.30	1.63
2.....	106.7		133.22	29.51	.97	1.21
4.....	209.		237.39	52.	.89	1.11
8.....	73.5		77.23	15.25	.84	1.05
12.....	207.1		244.28	46.75	.95	1.19
50.....	140.2		111.72	38.	.53	.66
	790.5		893.80	200.27	.88	1.10

APPENDIX D

EXTRACTS FROM "PLANNING THE CITY"

THE REASONS

(Extracts from Bulletin No. 4, Nat'l. Conference on City Planning.)

All successful enterprises of magnitude have been planned, and city building, in the complexity and variety of its problems, is an enterprise of the first magnitude. Millions have already been spent to remedy the errors of haphazard growth, most of which could have been avoided by a plan. These losses are not more definite because reckoned in money than the economic loss due to an overcrowded thoroughfare and the economic and social loss due to an overburdened street lot, or an overcrowded room. In every case the people pay the bills.

A comprehensive plan is the first step toward the solution of the social and industrial problems of the city. Bad housing and slums will continue so long as masses of people must live in a limited area. In the cheap and rapid distribution of population are involved a plan of rapid transit, a plan for the location of industries and a plan of streets, all of which are essential elements of the comprehensive city plan.

Commercial efficiency depends on the rapid and cheap transfer of merchandise. There must, therefore, be a transportation plan, which will include the location of water and land terminals, and distributing routes both inside the city and from the city to the rural districts.

Industrial efficiency depends on a contented working people. A plan, therefore, must provide places of recreation as well as places of work.

The most notable achievements in planning have been revenue producers. Test the truth of this statement by correspondence with the Kansas City Park Commission.

Many American municipalities have gone beyond the doubting period; they are now at work on systematic plans either through

the agency of an unofficial organization, under a regular department of administration, or through the agency of a new department known as a city plan commission.

THE OBSTACLES

Too little knowledge of the subject has resulted in the opposition of citizens of intelligence and influence who think city planning is another name for the "city beautiful," another way of spending the public's money without adequate return. This antagonism is often shared by the municipal official who honestly believes that there are enough executive departments without adding a plan commission.

Too little power has made it impossible for the city to acquire land reasonably and quickly. In most States the city is either restrained by the state legislature from desirable action in the furtherance of city planning, or, if the legislature is won over to the action, there is a prohibition in the state constitution.

And always the city is too poor to assume any great financial burdens. Existing municipal revenue is entirely inadequate. There is a limit to the tax rate which people will pay, and there is a limit to bonded municipal indebtedness arbitrarily fixed in every state constitution. There must therefore be a legislative and financial plan.

PROGRESS

IN LEGISLATION :

In Massachusetts city plan commissions are made mandatory in every city and town of 10,000 (Acts of 1913).

In Pennsylvania city plan commissions are authorized in cities of the first, second and third class (Acts of 1911 and 1913).

In New Jersey plan commissions are authorized in all cities of the first class (Acts of 1913).

In New York plan commissions are authorized in all cities and incorporated villages (Acts of 1913).

In several cities of Connecticut commissions are authorized under special act.

In Cleveland, Ohio, plan commissions are made mandatory under the new charter of 1913.

In Dayton, Ohio, a plan commission is authorized under the new charter of 1913.

In San Francisco, Cal., a plan commission is authorized under the charter amendment of 1912.

Cities have been given more right to acquire land and a better chance to pay for it in Massachusetts, under the constitutional

amendment adopted in 1911, incorporating the principle of excess condemnation.

In Ohio under the constitutional amendment adopted in 1912, providing for excess condemnation and the right to distribute the cost of improvements on specially benefited territory.

In Wisconsin and New York by a constitutional amendment allowing excess condemnation adopted by two legislatures and to be submitted to the people in 1913.

In several states by improvement in condemnation procedure.

PUBLICATIONS OF THE CONFERENCE

BULLETINS :

No. 1. Paying the Bills for City Planning. 10 cents a copy, \$5 a hundred.

No. 2. City Planning Legislation. 10 cents a copy, \$5 a hundred.

No. 3. City Planning Studies (nine plans submitted at the Chicago Conference for an ideal development of a 400-acre tract of land in accordance with the city planning principle), 30 cents a copy.

PROCEEDINGS (*uniformly bound in cloth*):

Rochester Conference, 1910, \$1.50.

Philadelphia Conference, 1911, \$1.50.

Boston Conference, 1912, \$2.00.

IN PRESS:

The Chicago Conference, about 250 pages, price \$2.17 post-paid.

TABLE OF CONTENTS

A City Planning Program. Frederick Law Olmsted, Brookline.

Progress of City Planning. Flavel Shurtleff, Esq., of the Boston Bar.

A City Planning Survey. George B. Ford, New York City.

The Legal Status of City Planning. Edward M. Bassett, Esq., of the New York Bar. Discussed by Andred Wright Crawford, Esq., of the Philadelphia Bar; Ernst Freund, Professor of Law, Chicago University; Alfred Bettman, City Solicitor of Cincinnati.

Organization and Functions of a City Planning Commission. Hon. W. A. Magee, Mayor of Pittsburgh. Discussed by members of city planning commissions.

Transportation and City Planning. Milo R. Maltbie, Public Service Commission, New York City. Discussed by Bion J. Arnold, of Chicago; Edward M. Bassett, Esq., New York City; E. P. Goodrich, New York City.

The Special Assessment Principle as Applied in Kansas City Parks and Boulevards. George E. Kessler, of St. Louis.

Gaining Public Support for a City Planning Movement. Charles H. Wacker, Chairman Chicago Plan Commission.

STUDIES IN CITY PLANNING:

Nine plans for a 400-acre tract on the outskirts of a city of about 500,000 population, with critical report of committee and discussion.

For publications address 19 Congress Street, Boston, Mass.

APPENDIX E

RESOLUTION

Amending the Charter of the City of Hartford Concerning a Commission on the City Plan

Approved March 26, 1907

GENERAL ASSEMBLY

January Session, A. D. 1907.

Resolved by this Assembly:

SECTION 1. That there shall be in the city of Hartford a commission on the city plan, which shall consist of the mayor, who shall be its presiding officer; the president of the board of street commissioners; the president of the board of park commissioners; the city engineer; two citizens, neither of whom shall hold any other office in said city government; one member of the board of aldermen, and one member of the common council board, to be appointed as hereinafter provided.

SEC. 2. The necessary expenses of said commission shall be paid by the city, but no member thereof shall be paid for his services as such member.

SEC. 3. During the month of April, 1907, the mayor shall appoint one citizen member of said commission to hold office for two years, and one citizen member to hold office for three years from the first of May then next ensuing, and in the month of April, 1909, and in April in the years thereafter when the terms of such citizen members respectively expire, the mayor shall appoint one citizen member of said commission for the term of three years from the first day of May then next ensuing. During the month of April, 1907, and in each April thereafter, the board of aldermen and the common council board of said city shall each appoint from its own number a member of said commission to hold office for the term of one year from and after the first day of May then next ensuing.

The members of said commission shall hold office until their respective successors are elected and qualified.

SEC. 4. All questions concerning the location of any public building, esplanade, boulevard, parkway, street, highway, square or park shall be referred to said commission by the court of common council for its consideration and report before final action is taken on such location.

SEC. 5. The court of common council may refer to said commission the construction or carrying out of any public work not expressly within the province of other boards or commissions of said city, and may delegate to said commission all powers which the said council deems necessary to complete such work in all details.

SEC. 6. Said commission may make or cause to be made a map or maps of said city, or any portion thereof, showing locations proposed by it for any new public building, esplanade, boulevard, parkway or street, and grades thereof, and street, building and veranda lines thereon, or for any new square or park, or any changes by it deemed advisable in the present location of any public building, street, grades and lines, square or park, and may employ expert advice in the making of such map or maps.

SEC. 7. Said city of Hartford, acting through said commission or otherwise, shall have power to appropriate, enter upon, and hold in fee real estate within its corporate limits for establishing esplanades, boulevards, parkways, park grounds, streets, highways, squares, sites for public buildings, and reservations in and about and along and leading to any or all of the same; and, after the establishment, layout, and completion of such improvements, may convey any real estate thus acquired and not necessary for such improvements, with or without reservations, concerning the future use and occupation of such real estate, so as to protect such public works and improvements and their environs, and to preserve the view, appearance, light, air and usefulness of such public works.

Approved March 26, 1907.

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